Carps and Minnows of Iran

(Families Cyprinidae and Leuciscidae)

Volume II: Minnows (Family Leuciscidae) and Bibliography

Brian W. Coad

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By

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Acknowledgements

Acknowledgements are in Volume I: General Introduction and Carps (Family Cyprinidae).

Minnows
(Family Leuciscidae)

An extensive **General Introduction** to cyprinoid fishes is given in Volume I covering Purpose of the Work, Materials and Methods, Environment, History of Research and Fisheries. This introductory section under Carps (Family Cyprinidae) in Volume I covers aspects of the classification, relationships, morphology and biology of the cyprinoid fishes found in Iran.

The status of the fish fauna in Iran was assessed by Coad (1980b) and Kiabi *et al*. (1999) and compared with other areas by Moyle and Leidy in Fiedler and Jain (1992). The percentage of the total fauna under some form of threat was assessed at 22%, a figure which was lower than most other areas examined. The IUCN assessments (2015; https://newredlist.iucnredlist.org/, downloaded at various times in 2019 and should be checked for updates) are given below for the leuciscid species over their whole distribution. Apart from Iranian endemics and species found mostly in Iran and adjacent countries, these assessments may not depend much on Iranian data. However, given human population increases and agricultural, domestic and industrial demands for water, pollution and drought in Iran, these assessments probably apply to Iran and may be conservative. Species not included have no assessment.

Critically Endangered: None.
Vulnerable: None.
Least Concern: *Abramis brama*, *Acanthobrama marmid*, *Acanthobrama microlepis*, *Alburnoides eichwaldii*, *Alburnus caeruleus*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Alburnus sellal*, *Ballerus sapa*, *Blicca bjoerkna*, *Chondrostoma cyri*, *Chondrostoma regium*, *Leucaspius delineatus*, *Leuciscus aspius*, *Leuciscus vorax*, *Pelecus cultratus*, *Scardinius erythrophthalmus*, *Squalius berak*, *Squalius lepidus*, *Squalius turcicus*.
Data Deficient: *Acanthobrama urmianus*.

Identification Keys

The leuciscids of Iran may be identified using the following keys, the first to genera and the subsequent ones to species within genera having more than one species. Volume I: Introduction and Carps (Family Cyprinidae) has more background on keys and techniques.

Note that key characters, e.g., fin ray counts, are restricted to Iranian species; species from elsewhere may not key out here. Distributions in the keys are also for Iran only and are based on 19 drainage basins (see map below in **Biodiversity**)

The keys are in two main sections, a **Key to Genera** and a **Key to Species within Genera** where there are two or more species.

Distributions in the keys are by drainage basin, except for exotic species which may occur widely as farmed fish or as accidental and deliberate releases that have not always been well-documented. Native fishes that have been translocated are mentioned. Characters in brackets [....] may not apply to all genera or species below them in the key but are additional characters that aid identification for that particular genus or species. Illustrations are taken from the Species Accounts where the source is acknowledged.

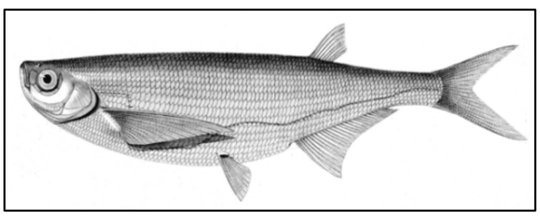
A few general illustrations were given under Cyprinidae to show characters that appear repeatedly in the keys to both Carps and Minnows.

Definitions of characters may be found in the *Dictionary of Ichthyology* at www.briancoad.com. Thickened fin rays are referred to as spines for convenience in this key, although they are not true spines.

Key to Genera of Leuciscidae

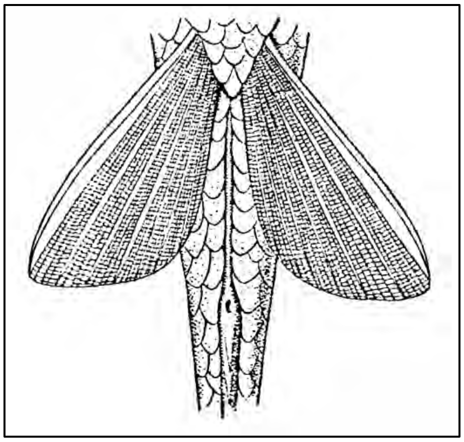
Species that are the only one in the genus will key out here and are illustrated.

1a. Scaleless (or naked) keel from the throat to the anal fin; mouth almost vertical; lateral line very wavy; dorsal fin origin behind anal fin origin; Caspian Sea basin = *Pelecus cultratus*
1b. Not as above ---> **2**



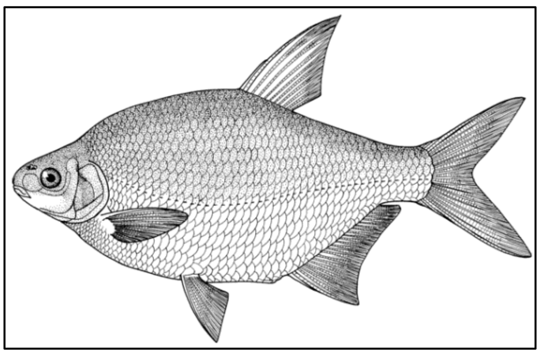
Pelecus cultratus

2a. Naked ventral keel of varying extent between pelvic fin bases and anal fin ---> **3**
2b. Naked ventral keel absent ---> **8**



Naked ventral keel in *Alburnoides* sp.

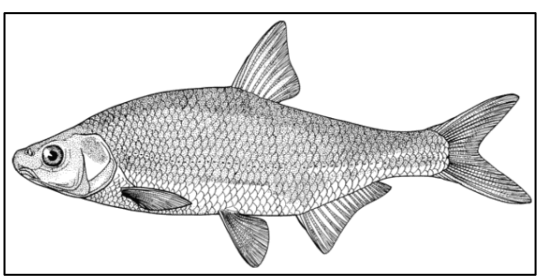
3a. Scaleless groove on back before dorsal fin; [mouth small, oblique and subterminal; anal fin branched rays 16-24; pharyngeal teeth usually 2,5-5,2]; Caspian Sea basin = *Blicca bjoerkna*
3b. No groove on back ---> **4**



Blicca bjoerkna

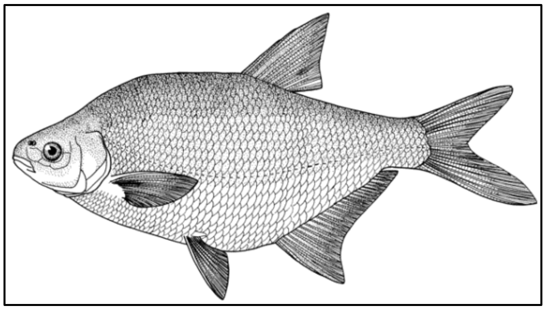
4a. Anal fin branched rays 16-44; pharyngeal teeth in one row (usually 5-5) ---> **5**
4b. Anal fin branched rays 7-21, usually less than 16; pharyngeal teeth in two rows (usually 2,5-4,2 or 2,5-5,2) ---> **7**

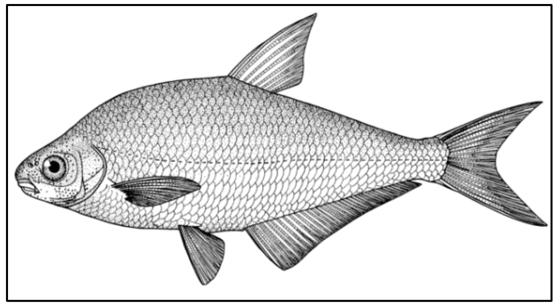
5a. Scaled keel behind dorsal fin; anal fin origin behind a vertical from dorsal fin end; Caspian Sea basin = *Vimba persa*
5b. No scaled keel behind dorsal fin; anal fin origin before a vertical from dorsal fin end ---> **6**



Vimba persa

6a. Anal fin branched rays 22-30 (mostly 24-28); dorsal fin branched rays modally 9; Caspian Sea basin = *Abramis brama*
6b. Anal fin branched rays 31-44 (mostly 34-38); dorsal fin branched rays modally 8; Caspian Sea basin = *Ballerus sapa*


Abramis brama


Ballerus sapa

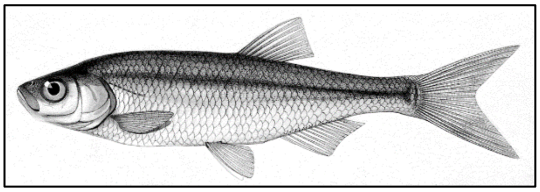
7a. Gill rakers short; pharyngeal teeth usually unserrated; Caspian Sea, Dasht-e Kavir, Esfahan, Hari River, Kor River, Lake Urmia, Namak Lake, Persis, Sirjan and Tigris River basins = *Alburnoides*
7b. Gill rakers long; pharyngeal teeth usually serrated; Caspian Sea, Esfahan, Hari River, Hormuz, Kor River, Lake Maharlu, Lake Urmia, Namak Lake, Persis and Tigris River basins = *Alburnus*

8a. Last dorsal fin unbranched ray thickened as a smooth spine (note *Acanthobrama persidis* lacks this spine and keys out below); Caspian Sea, Hormuz, Kor River, Lake Maharlu, Lake Urmia, Persis and Tigris River basins = *Acanthobrama*
8b. Last dorsal fin unbranched ray not a spine ---> **9**

9a. Mouth a ventral arch; lower jaw with horny anterior edge; Caspian Sea, Esfahan, Kor River, Persis and Tigris River basins = *Chondrostoma*
9b. Mouth terminal or subterminal, not arched; lower jaw without horny anterior edge ---> **10**

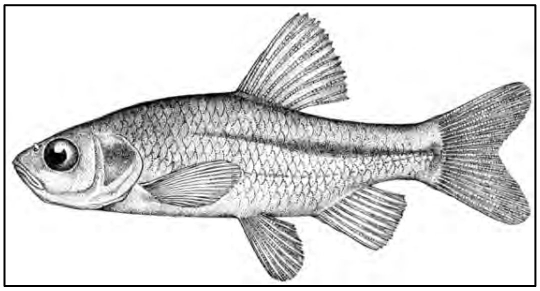

Ventral arch mouth
of *Chondrostoma*

10a. Lateral line incomplete with 0-13 pored scales; females with large, rounded papillae around the genital opening; Caspian Sea basin = *Leucaspius delineatus*
10b. Not as above ---> **11**



Leucaspius delineatus

11a. Flanks with a stripe evident posteriorly but fading anteriorly and not reaching the head; pharyngeal teeth 1,5-4,1; [dorsal fin branched rays modally 7; lateral line scales 35-43]; Hormuz, Kor River, Lake Maharlu and Persis basins = *Acanthobrama persidis*
11b. Not as above ---> **12**

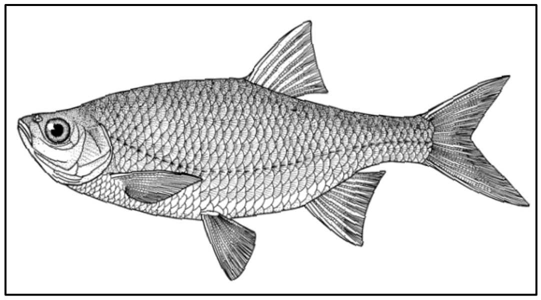


Acanthobrama persidis

12a. Lateral line scales 62-110, mostly 65 or more; large mouth with the lower jaw projecting; Caspian Sea and Tigris River basins = *Leuciscus*
12b. Lateral line scales 36-68, mostly 58 or less; mouth relatively small, terminal or subterminal ---> **13**

Large mouth and projecting lower jaw in *Leuciscus*

13a. Scaled keel on belly; pharyngeal teeth 3,5-5,3; [dorsal fin branched rays 7-10, usually 8; anal fin branched rays 9-13, usually 11]; Caspian Sea basin = *Scardinius erythrophthalmus*
13b. Not as above ---> **14**



Scardinius erythrophthalmus

14a. Pharyngeal teeth in a single row, 6-5 or 5-5; [dorsal fin branched rays 8-12, usually 9-10; anal fin branched rays 8-12, usually 9-10]; Caspian Sea basin = *Rutilus*
14b. Pharyngeal teeth in two rows, usually 2,5-4,2 or 2,5-5,2; [dorsal fin branched rays 7-10, usually 7-9; anal fin branched rays 7-11, usually 8-9]; Caspian Sea, Dasht-e Kavir, Hari River Namak Lake and Tigris River basins = *Squalius*

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Verbal Key to Genera of Leuciscidae

The key characters of the genera are summarised below, restricted to Iranian species only. Characters may not be unique to a genus but the combination of characters is unique.

Abramis: naked ventral keel (between pelvic fin bases and anal fin); anal fin branched rays 22-30 (mostly 24-28); dorsal fin branched rays modally 9; pharyngeal teeth in one row
Acanthobrama: last dorsal fin unbranched ray thickened as a smooth spine; no ventral keel
Alburnoides: ventral keel of varying naked extent; anal fin branched rays 8-16; unserrated pharyngeal teeth in two rows; gill rakers short
Alburnus: ventral keel of varying naked extent; anal fin branched rays 7-21, usually 18 or less; serrated pharyngeal teeth in two rows; gill rakers long
Ballerus: ventral keel of varying naked extent; anal fin branched rays 31-44 (mostly 34-38); dorsal fin branched rays modally 8; pharyngeal teeth in one row
Blicca: ventral keel naked; scaleless groove on back before dorsal fin
Chondrostoma: mouth ventral and arched; lower jaw with horny edge; pharyngeal teeth 5-5, 6-5 or 6-6; last dorsal fin unbranched ray not a spine; no ventral keel;
Leucaspius: lateral line incomplete with 0-13 pored scales
Leuciscus: large mouth with the lower jaw projecting; lateral line scales 62-110
Pelecus: naked ventral keel from the throat to the anal fin
Rutilus: mouth not arched; pharyngeal teeth 6-5 or 5-5
Scardinius: scaled keel on belly; pharyngeal teeth 3,5-5,3
Squalius: mouth not arched; pharyngeal teeth 2,5-4,2
Vimba: naked ventral keel; anal fin branched rays 12-22; scaled keel behind dorsal fin; pharyngeal teeth 5-5

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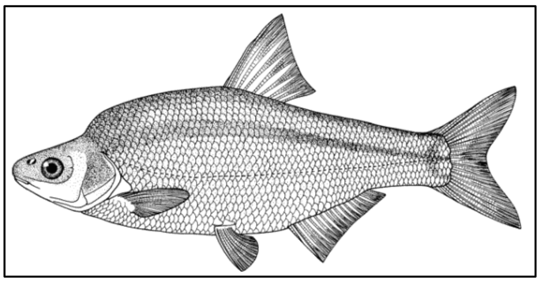
Keys to Species within Genera of Leuciscidae

Note that some species have been defined by DNA while morphological differences comprise overlapping characters ("characters in combination, none unique") and so individual specimens may be difficult to identify in the field, the laboratory or in the literature based on external morphology. Distribution is therefore often important. A single species is shown to represent each genus as body form is generally similar.

Key to *Acanthobrama*



Acanthobrama marmid

1a. Lateral line scales 35-43; dorsal fin branched rays modally 7; anal fin branched rays 7-11, usually 9 or less; dorsal fin spine and naked ventral keel absent; Hormuz, Kor River, Lake Maharlu and Persis basins = *Acanthobrama persidis*
1b. Lateral line scales 50 or more; dorsal fin branched rays modally 8; anal fin branched rays 10 or more; dorsal fin spine and naked ventral keel present ---> **2**

2a. Pharyngeal teeth in one row (5-5); total gill rakers 12-17; [anal fin branched rays 13-22]; Tigris River basin = *Acanthobrama marmid*
2b. Pharyngeal teeth in two rows (1 or 2 in outer row, 4 or 5 in inner row); total gill rakers 10-14; [anal fin branched rays 10-19]; Caspian Sea and Lake Urmia basins ---> **3**

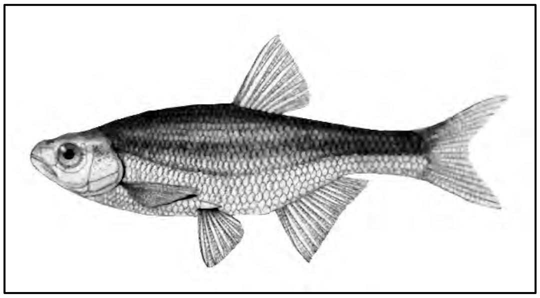
3a. Anal fin branched rays 12-19; lateral line scales 60-87; Caspian Sea basin = *Acanthobrama microlepis*
3b. Anal fin branched rays 10-13; lateral line scales 50-68; Lake Urmia basin = *Acanthobrama urmianus*

Key to *Alburnoides*

Modified after Coad and Bogutskaya (2009) and Mousavi-Sabet *et al*. (2015), this key is unsatisfactory as meristic and morphometric characters overlap between species, although modes and means of counts may be different, and colour pattern of the lateral line and keel development vary between and within species. Large samples of specimens of a species naturally show wider ranges in character states than in smaller samples, and thus reduce the efficacy of possible

distinctions when individual fish or small samples are to be identified. Ranges and percentages here serve to indicate degree of overlap and refine the usefulness of previous keys. DNA defines species (with some disagreements between authors) and for practical purposes in the field, in older preserved specimens and in literature records, distribution is key. The table under the genus summarises distribution.

Note that translocation of these small fish, evident in other species such as *Alburnus hohenackeri*, has not been investigated and is a potential source of confusion.



Alburnoides eichwaldii

1a. Snout pointed or slightly rounded; mouth terminal or upturned, tip of mouth cleft on level from slightly above middle of eye to upper margin of pupil; lower jaw slightly to moderately projecting relative to upper jaw; junction of lower jaw and quadrate on about vertical through anterior eye margin; Atrak, Hari, Kor River and Sirjan basins ---> **2**
1b. Snout slightly to markedly rounded; mouth terminal to subterminal, tip of mouth cleft on level from middle of eye to below lower margin of eye; upper jaw slightly to moderately projecting relative to lower jaw; junction of lower jaw and quadrate on about vertical through about middle of eye ---> **4**

2a. Kor River and Sirjan basins; ventral keel completely scaled = *Alburnoides qanati*
2b. Atrak and Hari River basins; ventral keel completely or almost completely scaleless ---> **3**

3a. Hari River basin; mostly 14-16 anal fin branched rays (90.7%, range 10-16) = *Alburnoides holciki*
3b**.** Atrak River basin; mostly 12-13 anal fin branched rays (83.3%, range 11-15) = *Alburnoides parhami*

4a. Anal fin branched rays 8-13, mostly 8-11 (96.0%) with 8-10 at 76.6%; dorsal fin branched rays 7-8, often 7 ---> **5**
4b. Anal fin branched rays 9-16, mostly 11-14 (96.4%); dorsal fin branched rays 8, rarely 7 ---> **6**

5a**.** Nurabad River of Tigris River basin; dorsal fin branched rays 7(91.3%); **v**entral keel scaleless from one-third to whole keel length; 38-40, commonly 39, total vertebrae; 19-20, commonly 20, abdominal vertebrae = *Alburnoides nicolausi*
5b**.** Lake Urmia basin; dorsal fin branched rays 7(49.0%) or 8(51.0%); **v**entral keel completely scaled; commonly 40-41 total vertebrae; 20-22, commonly 21, abdominal vertebrae = *Alburnoides petrubanarescui*

6a. Ventral keel usually completely or partly scaled ---> **7**
6b. Ventral keel usually completely or almost completely scaleless ---> **9**

7a**.** Tigris River basin; anal fin branched rays mostly 11-12 (94.7%, range 9-12); total scale radii 12-17; [lateral line scales 39-49] = *Alburnoides idignensis*
7b**.** Outside Tigris River basin in northern basins; anal fin branched rays mostly 11-14 (85.5%, range 10-16, often 13 or more at 44.2%); total scale radii 16-19 ---> **8**

8a**.** Western Dasht-e Kavir basin; eye located in the anterior half of head; predorsal vertebrae 13-14 (72.5 and 27.5%); orbit width smaller than interorbital width; deep body and head = *Alburnoides coadi*
8b. Western Caspian Sea basin from Sefid River basin (or just east) and then west (except the Aras River basin; eye located in the mid-head; predorsal vertebrae mostly 12-13 (44.2 and 52.1%); orbit width about equal to interorbital width; shallow body and head = *Alburnoides samiii*

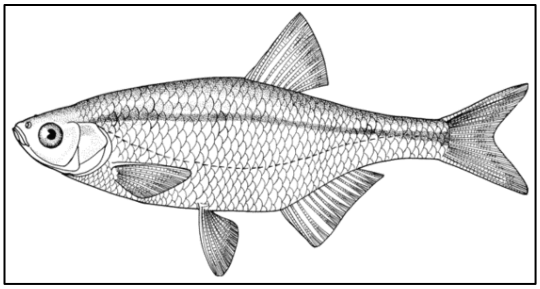
9a**.** Aras River basin in Caspian Sea basin; lateral line in live and preserved fish delineated by dark pigment dots above and below; predorsal vertebrae 12-15, mostly 13-14 (93.0%; 38.1% with 13) = *Alburnoides eichwaldii*
9b**.** Lateral line in live and preserved fish somewhat darker than surrounding flank but no strong dark dots outline canal; predorsal vertebrae 11-14, mostly 12-13 (89.1%; 31.2% with 13) ---> **10**

10a. Cheshmeh Ali and adjacent waters of the northern Dasht-e Kavir basin = *Alburnoides damghani*
10b. Other basins ---> **11**

11a. Namak Lake basin; eye relatively large (27.7-34.5, mean 31.3 in head length) = *Alburnoides namaki*
11b. Eastern Caspian Sea basin east of the Sefid River basin (except the Atrak River); eye relatively small (23.6-34.0, mean 27.9 in head length) = *Alburnoides tabarestanensis*

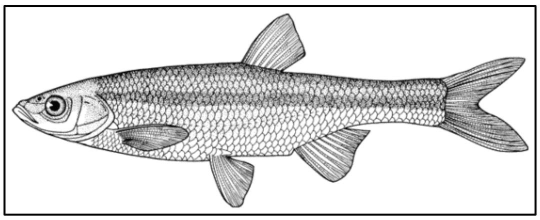
Key to *Alburnus*

Translocation of these small species may be more widespread than documented. See, as an example, under the *Alburnus hohenackeri* description.



Alburnus hohenackeri

1a. Dorsal fin branched rays modally 7; strong mid-flank stripe [anal fin branched rays 9-13, usually 10-12; anal fin origin below or behind last dorsal fin ray; total gill rakers 12-21; lateral line scales 46-64, usually 57 or less]; Caspian Sea basin = *Alburnus filippii*
1b. Dorsal fin branched rays modally 8; no strong stripe in Caspian Sea species ---> **2**



Mid-flank stripe in *Alburnus filippii*

2a. Total gill rakers 18-31, usually 19 or more; Caspian Sea basin ---> **3**
2a. Total gill rakers 8-23, usually 16 or less in all but one species; outside Caspian Sea basin ---> **4**

3a. Lateral line scales 54-74, usually 55 or more; abdominal keel partly covered by scales, no more than half naked; peritoneum light brown; Caspian Sea basin = *Alburnus chalcoides*
3b. Lateral line scales 34-55, usually 45 or less; abdominal keel mostly naked; peritoneum light silvery; Caspian Sea basin and translocated = *Alburnus hohenackeri*

4a. Hari River basin; [total gill rakers 13-23; lateral line scales 30-46; anal fin branched rays 9-13] = *Alburnus taeniatus*
4b. Outside Hari River basin ---> **5**

5a. Lake Urmia basin ---> **6**
5b. Tigris River and basins of central and southern Iran ---> **7**

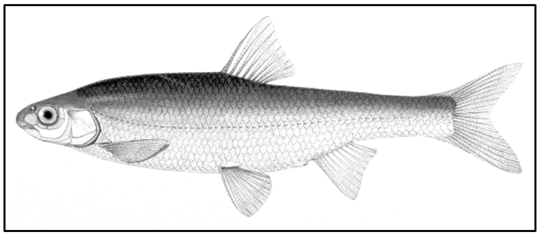
6a. Lateral line scales 46-63; peritoneum black = *Alburnus atropatenae*
6b. Lateral line scales 35-45; peritoneum silvery-brown = *Alburnus ulanus*

7a. Lateral line scales 58-89, usually 62 or more; Esfahan, Hormuz, Kor River, Lake Maharlu, Persis and Tigris River basins = *Alburnus sellal*
7b. Lateral line scales 43-59, usually 57 or less ---> **7**

8a. Anal fin branched rays 13-18; total gill rakers 10-13; Tigris River basin = *Alburnus caeruleus*
8b. Anal fin branched rays 9-12; total gill rakers 12-18; Esfahan, Namak Lake and Tigris River basins = *Alburnus doriae*

Key to *Chondrostoma*

Modified after Eagderi *et al*. (2017).



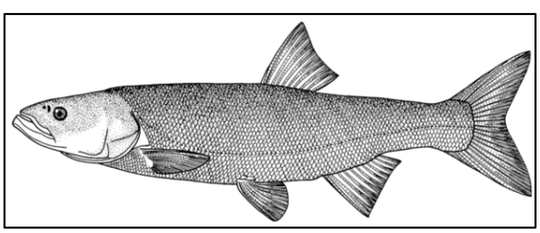
Chondrostoma cyri

1a. Total gill rakers 15-17; snout short and rounded (17.1-20.8 in % of head length); mouth arched without a horny blade on lower jaw; caudal fin shallow with rounded lobes; Tigris River basin = *C. esmaeilii*
1b. Total gill rakers 17, usually 20, or more; snout long (25.5 or more in % of head length); mouth straight to slightly arched with a horny blade on lower jaw; caudal fin forked with pointed lobes ---> **2**

2a. Caspian Sea basin; [lateral line scales 47-73; dorsal fin branched rays usually 8; anal fin branched rays usually 9-10; total gill rakers usually 21 or more] = *Chondrostoma cyri*
2b. Outside Caspian Sea basin ---> **3**

3a. Kor River basin; [lateral line scales 47-57; dorsal fin branched rays usually 8; anal fin branched rays usually 9; total gill rakers 25 or more] = *Chondrostoma orientale*
3b. Esfahan, Persis and Tigris River basins; [lateral line scales 50-73; dorsal fin branched rays usually 8-9; anal fin branched rays usually 9-11; total gill rakers 18, usually 20, or more = *Chondrostoma regium*

Key to *Leuciscus*

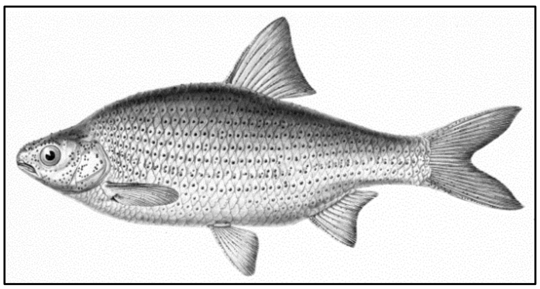


Leuciscus vorax

The distinction of *L. aspius* and *L. vorax* has not been examined recently and characters overlap, sample sizes for gill rakers and scales in particular being very small. However, they are found in widely separated basins.

1a. Lateral line scales 62-105; anal fin branched rays 11-16, usually 12-13; total gill rakers 8-11; total vertebrae 47-51; Caspian Sea basin = *Leuciscus aspius*
1b. Lateral line scales 82-110; anal fin branched rays 9-13, usually 10-11; total gill rakers 9-14; total vertebrae 51-53; Tigris River basin = *Leuciscus vorax*

Key to *Rutilus*



Rutilus lacustris

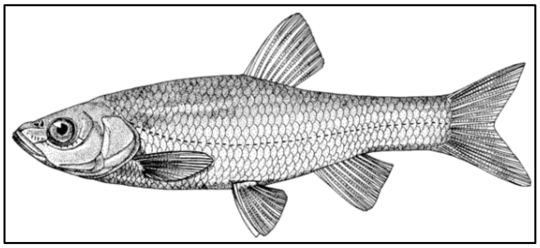
1a. Lateral line scales 47-68, mostly 55-58; gas bladder elongate and conical, or pointed, posteriorly; Caspian Sea basin = *Rutilus kutum*
1b. Lateral line scales 39-48, mostly 42-47; gas bladder rounded posteriorly; Caspian Sea basin = *Rutilus lacustris*

Note: *Rutilus lacustris* (formerly recognised as a single taxon in Iran: *Rutilus rutilus*, as a subspecies *R. r. caspicus* or as *R. caspicus*) and *R. rutilus* are not recognised or separated here as distinct taxa in the Iranian Caspian Sea basin. They may be distinct taxa based on migratory habits and characters listed in Kottelat and Freyhof (2007) and general literature. Some characters do not agree between studies, others overlap, or are only visible on fresh material. The key characters below have yet to be examined in detail in resident and migratory Iranian specimens.

1a. Lateral line scales mostly 41-43 (or mostly 42-44); dorsal fin branched rays 8-10, mostly 9; depth of body 24-37% of standard length (mostly 29-31%); mouth subterminal and top lower than level of lower margin of eye; snout rounded; iris and pectoral, pelvic and anal fins usually without yellow, orange or red pigment (iris silvery-grey, dark margined fins, slightly red in autumn outside spawning season); migratory; Caspian Sea basin = *Rutilus lacustris*
1b. Lateral line scales mostly 43-45 (or mostly 39-41); dorsal fin branched rays 9-11, mostly 10; depth of body 25-36% of standard length (mostly 33-35%); mouth terminal or almost terminal and top above level of lower margin of eye; snout pointed; iris and pectoral, pelvic and anal fins always with yellow, orange or red pigment; non-migratory; Caspian Sea basin = *Rutilus rutilus*

Key to *Squalius*

Modified after Khaefi *et al*. (2016). There is more variation in characters than given in the key by Khaefi *et al*. (2016) and distribution is the key character.



Squalius lepidus

1a. Dorsal fin branched rays modally 7; Hari River basin = *Squalius latus*
1b. Dorsal fin branched rays modally 8-9; Caspian Sea, Dasht-e Kavir, Namak Lake and Tigris River basins ---> **2**

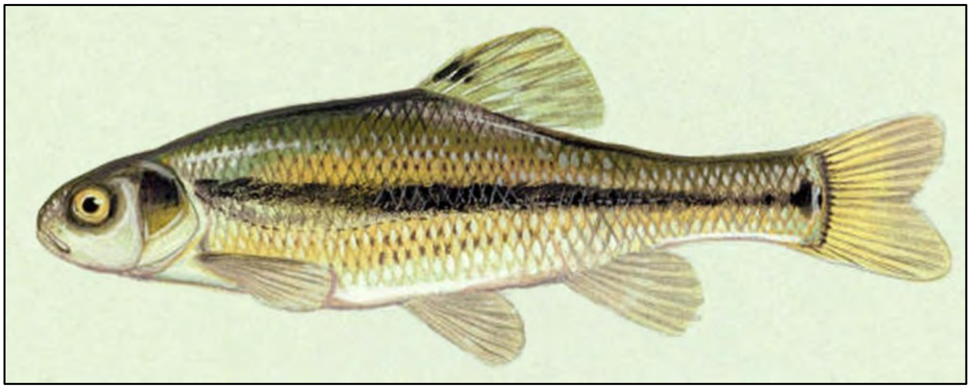
2a. Head elongate and pointed with a strongly projecting lower jaw; Tigris River basin = *Squalius lepidus*
2b. Not as above ---> **3**

3a. Knob on lower jaw symphysis wide, thick; posterior tip of each flank scale with a bold grey or brown, roundish or crescent-shaped blotch; Dasht-e Kavir and Namak Lake basins = *S. namak*
3b. Knob on lower jaw symphysis narrow, thin or absent; posterior tip of flank scales usually without bold blotch -> **4**

4a. Caudal, anal and pelvic fin rays hyaline or with a grey or yellow hue in life; knob on lower jaw symphysis absent; Tigris River basin = *Squalius berak*
4b. Caudal, anal and pelvic fin rays orange in life; knob on lower jaw symphysis small; Caspian Sea and Lake Urmia basins = *Squalius turcicus*

Checklists

One exotic species, the fathead minnow (*Pimephales promelas* Rafinesque, 1820) from North America, recorded by Andersskog (1970), does not appear to have become established and is omitted from this work.



Pimephales promelas
(Pimephales promelas2, CC0, U.S. Fish and Wildlife Service, Duane Raver).

Family Leuciscidae

An asterisk (*) marks Iranian endemics as currently understood. Some species are found in basins shared with neighbouring countries but there are no records of the species outside Iran.

Abramis brama (Linnaeus, 1758)

Acanthobrama marmid Heckel, 1843
Acanthobrama microlepis (De Filippi, 1863)
**Acanthobrama persidis* (Coad, 1981)
**Acanthobrama urmianus* (Günther, 1899)

**Alburnoides coadi* Mousavi-Sabet, Vatandoust and Doadrio, 2015
**Alburnoides damghani* Jouladeh Roudbar, Eagderi, Esmaeili, Coad and Bogutskaya, 2016
Alburnoides eichwaldii (De Filippi, 1863)
Alburnoides holciki Coad and Bogutskaya, 2012
**Alburnoides idignensis* Bogutskaya and Coad, 2009
**Alburnoides namaki* Bogutskaya and Coad, 2009
**Alburnoides nicolausi* Bogutskaya and Coad, 2009
**Alburnoides parhami* Mousavi-Sabet, Vatandoust and Doadrio, 2015
**Alburnoides petrubanarescui* Bogutskaya and Coad, 2009
**Alburnoides qanati* Coad and Bogutskaya, 2009
**Alburnoides samiii* Mousavi-Sabet, Vatandoust and Doadrio, 2015
**Alburnoides tabarestanensis* Mousavi-Sabet, AnvariFar and Azizi, 2015
**Alburnoides* sp. Esfahan basin
**Alburnoides* sp. Persis basin

**Alburnus atropatenae* Berg, 1925
Alburnus caeruleus Heckel, 1843
**Alburnus chalcoides* (Güldenstädt, 1772)
**Alburnus doriae* De Filippi, 1865
Alburnus filippii Kessler, 1877
Alburnus hohenackeri Kessler, 1877
Alburnus sellal Heckel, 1843
Alburnus taeniatus Kessler, 1874
**Alburnus ulanus* Günther, 1899

Ballerus sapa (Pallas, 1814)

Blicca bjoerkna (Linnaeus, 1758)

Chondrostoma cyri Kessler, 1877
**Chondrostoma esmaeilii* Eagderi, Jouladeh-Roudbar, Birecikligil, Çiçek and Coad, 2017
**Chondrostoma orientale* Bianco and Banarescu, 1982
Chondrostoma regium (Heckel, 1843)

Leucaspius delineatus (Heckel, 1843)

Leuciscus aspius (Linnaeus, 1758)
Leuciscus vorax (Heckel, 1843)

Pelecus cultratus (Linnaeus, 1758)

Rutilus kutum (Kamensky, 1901)
Rutilus lacustris (Pallas, 1814)

Scardinius erythrophthalmus (Linnaeus, 1758)

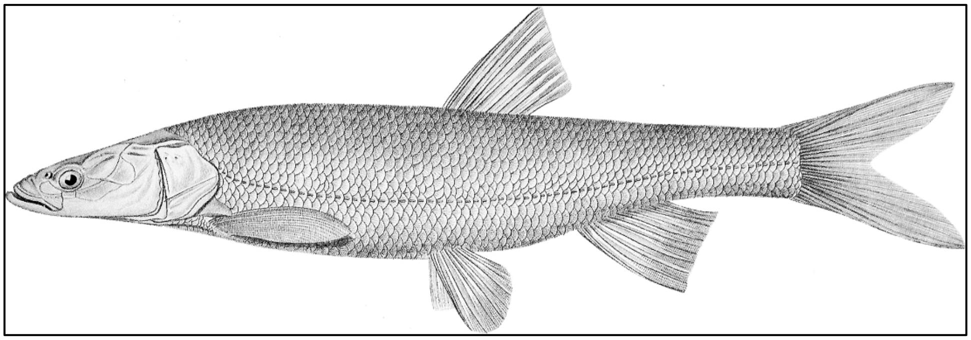
Squalius berak Heckel, 1843
Squalius latus Keyserling, 1861
Squalius lepidus Heckel, 1843
**Squalius namak* Khaefi, Esmaeili, Sayyadzadeh, Geiger and Freyhof, 2016
Squalius turcicus De Filippi, 1865

Vimba persa (Pallas, 1814)

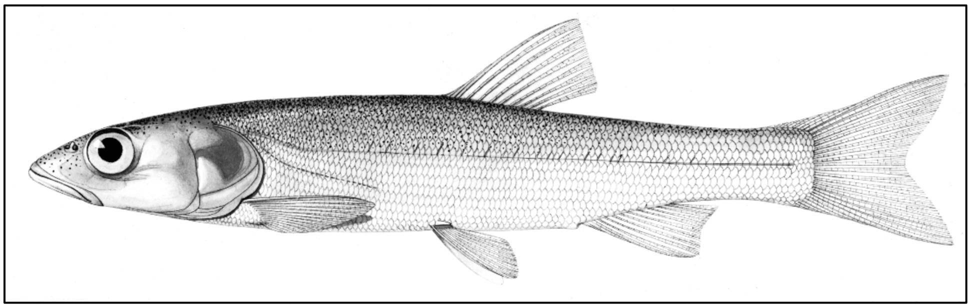
The following species have been recorded in water bodies shared with, or neighbouring, Iran and eventually may be found in Iran.

In the Hari (= Tedzhen) River basin of Afghanistan and Turkmenistan and/or the connected Karakum Canal of Turkmenistan:-

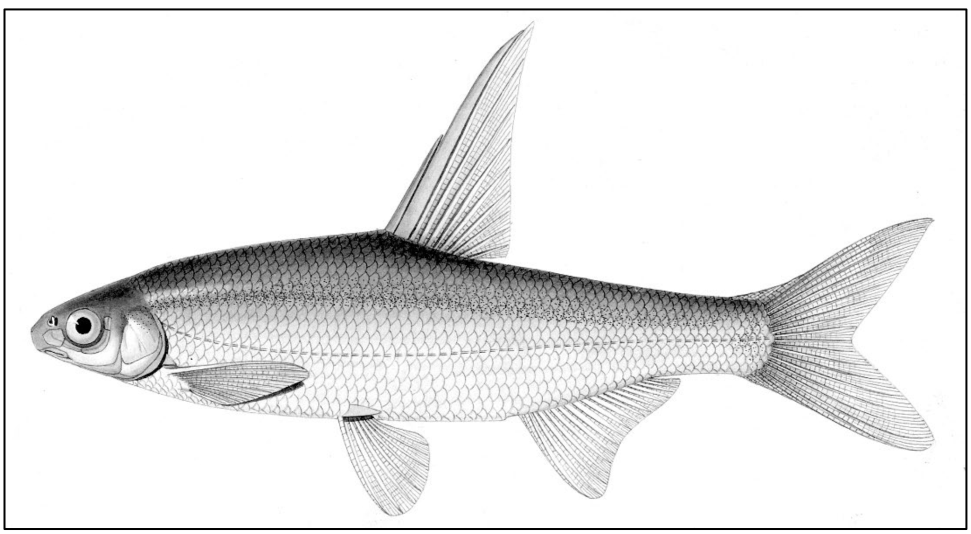
Aspiolucius esocinus (Kessler, 1874)
Capoetobrama kuschakewitschi (Kessler, 1872)



Aspiolucius esocinus, after Kessler (1874b).



Aspiolucius esocinus, fry, after Berg (1948-1949).



Capoetobrama kuschakewitschi, after Berg (1948-1949).

In drainages of southern Turkmenistan:-

Alburnoides varentsovi Bogutskaya and Coad, 2009

Alburnoides varentsovi, after Bogutskaya and Coad (2009).

Biodiversity

The minnow or leuciscid fauna of Iran comprises 45-47 native species in 14 genera (two putative species not formally described hence the ranges here and below). For comparison, Turkey has 122 native species (Kuru *et al*., 2014; Çiçek *et al*., 2015; Sungur Birecikligil *et al*., 2017; Çiçek *et al*., 2020), Afghanistan has 9 native species (Coad, 2014), Iraq has 8 native species (Coad, 2010; *Catalog of Fishes*, downloaded 27 September 2018), the Arabian Peninsula has 1 native species (Freyhof *et al*., 2020), and Pakistan has none (Mirza, 2003).

Minnows comprise about 19% of the freshwater ichthyofauna of Iran while carps comprise about 24% (Esmaeili *et al*., 2017; *Catalog of Fishes*, downloaded 27 September 2018). New species are likely to be found and will be endemics, with a restricted distribution that enhances the biodiversity of a particular drainage basin or ecoregion but has a restricted utility in comparing basins zoogeographically on presence-absence data, unless their genetic relationships also become known.

There are 19-21 species endemic to Iran (42.2-44.6% of the minnows) (see **Checklist** above). Endemics in the Caspian Sea and Tigris River basins may eventually be found in adjacent countries (see below).

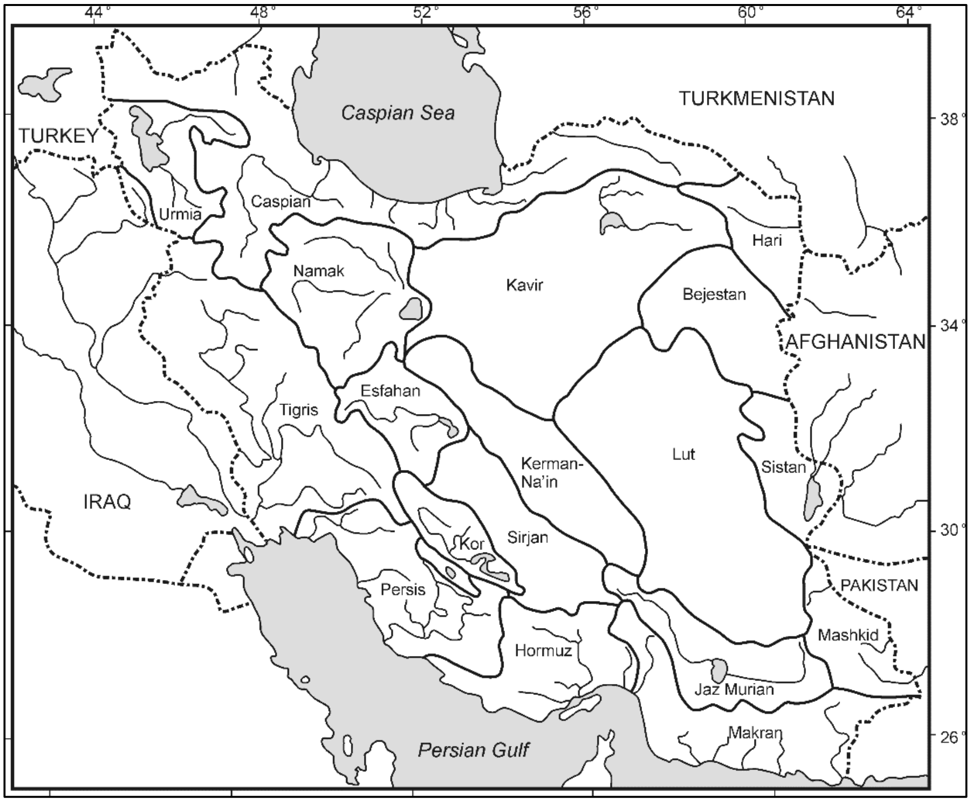
The most diverse genera are *Alburnoides* (12-14) and *Alburnus* (9) or 44.7-48.9% of the fauna. All other genera have five or less species and seven genera are monotypic. No genus is endemic to Iran.

Recent studies have increased the number of minnow species known from Iran. In the 100 years of the twentieth century (1900-1999) only 6 nominal species/subspecies of Leuciscidae were described from Iran while in the first 20 years of the twenty-first century (2000-2019) 15 species were described, 11 of these being in the genus *Alburnoides*.

Pourshabanan *et al*. (2021) assessed the biodiversity of leuciscids in the Caspian Sea basin of Iran using molecular methods and noted that the presence of *Ballerus sapa* and *Pelecus cultratus* needs confirmation.

Biodiversity by drainage basins and ecoregions are summarised below.

1) Native species distribution by drainage basins (number of species in parentheses; endemics indicated by * - endemics are by basin which may extend beyond Iran):-



Major drainage basins of Iran
(the Lake Maharlu basin lies between the Kor River and Persis basins),
Susan Laurie-Bourque @ Canadian Museum of Nature.

An asterisk (*) marks endemics which here are endemic to the basin but may include waters outside Iran (in the Caspian Sea, Tigris River and Hari River basins). An octothorpe (#) marks species requiring confirmation of this distribution.

a) Exorheic basins

Hormuz (2): *Acanthobrama persidis*, *Alburnus sellal*.

Makran (0): None.

Persis (former Gulf) (4, 1 endemic): *Acanthobrama persidis*, **Alburnoides* sp., *Alburnus sellal*, *Chondrostoma regium*.

Tigris River (11, 3 endemic): *Acanthobrama marmid*, **Alburnoides idignensis*, **Alburnoides nicolausi*, *Alburnus caeruleus*, *Alburnus doriae*, *Alburnus sellal*, **Chondrostoma esmaeilii*, *Chondrostoma regium*, *Leuciscus vorax*, *Squalius berak*, *Squalius lepidus*.

b) Endorheic basins

Bejestan (0): None.

Caspian Sea (20, 12 endemics): *Abramis brama*, **Acanthobrama microlepis*, **Alburnoides eichwaldii*, **Alburnoides parhami*, **Alburnoides samiii*, **Alburnoides tabarestanensis*, **Alburnus chalcoides*, **Alburnus filippii*, **Alburnus hohenackeri*, *Ballerus sapa*, *Blicca bjoerkna*, **Chondrostoma cyri*, *Leucaspius delineatus*, *Leuciscus aspius*, *Pelecus cultratus*, **Rutilus kutum*, *Rutilus lacustris*, *Scardinius erythrophthalmus*, **Squalius turcicus*, **Vimba persa*.

Dasht-e Kavir (3, 2 endemics): **Alburnoides coadi*, **Alburnoides damghani*, *Squalius namak*.

Dasht-e Lut (0): None.

Esfahan (4, 1 endemic): **Alburnoides* sp., *Alburnus doriae*, *#Alburnus sellal*, *Chondrostoma regium*.

Hamun-e Mashkid (0): None.

Hamun-e Jaz Murian (0): None.

Hari River (3): *Alburnoides holciki*, *Alburnus taeniatus*, *Squalius latus*.

Kerman-Na'in (0): None.

Kor River (4, 1 endemic): *Acanthobrama persidis*, *Alburnoides qanati*, *Alburnus sellal*, **Chondrostoma orientale*.

Lake Maharlu (2): *Acanthobrama persidis*, *Alburnus sellal*.

Lake Urmia (4, 3 endemics): **Acanthobrama urmianus*, **Alburnoides petrubanarescui*, **Alburnus ulanus*, *Squalius turcicus*.

Namak Lake (3, 1 endemic): **Alburnoides namaki*, *Alburnus doriae*, *Squalius namak*.

Sirjan (1): *Alburnoides qanati*.

Sistan (0): None.

Thirteeen of nineteen basins have 3 or fewer species (and 7 of these have none) and these are all eastern basins, remote from the distribution of the family Leuciscidae. Two basins have 4 species and one basin has 5 species, both adjacent to more speciose basins and with prior connections. The Lake Urmia basin is notable for its high degree of endemicity, with species derived from Caspian Sea relatives that have speciated in the now isolated basin. The Caspian Sea basin has by far the most species (20) and Iranian endemics (10), a result of its long history of connection and isolation from basins to the west where leuciscids predominate, to its large size and also its diverse habitats. The Tigris River basin, also with its large size, diverse habitats and long speciation history has the second most diversity and number of endemics (3 of 11 species).

2) Native species distribution in drainage basins (unconfirmed distributions above included and indicated by a question mark):-

Abramis brama: Caspian Sea.

Acanthobrama marmid: Tigris River.
Acanthobrama microlepis: Caspian Sea.
Acanthobrama persidis: Hormuz, Kor River, Lake Maharlu, Persis.
Acanthobrama urmianus: Lake Urmia.

Alburnoides coadi: Dasht-e Kavir.
Alburnoides damghani: Dasht-e Kavir.
Alburnoides eichwaldii: Caspian Sea.
Alburnoides holciki: Hari River.
Alburnoides idignensis: Tigris River.
Alburnoides namaki: Namak Lake.
Alburnoides nicolausi: Tigris River
Alburnoides parhami: Caspian Sea.
Alburnoides petrubanarescui: Lake Urmia.
Alburnoides qanati: Kor River, Sirjan.
Alburnoides samiii: Caspian Sea.
Alburnoides tabarestanensis: Caspian Sea.
Alburnoides sp.: Esfahan basin.
Alburnoides sp.: Persis basin.

Alburnus atropatenae: Lake Urmia.
Alburnus caeruleus: Tigris River.
Alburnus chalcoides: Caspian Sea.
Alburnus doriae: Esfahan, Namak Lake, Tigris River.
Alburnus filippii: Caspian Sea.
Alburnus hohenackeri: Caspian Sea.
Alburnus sellal: #Esfahan, Hormuz, Kor River, Lake Maharlu, Persis, Tigris River.
Alburnus taeniatus: Hari River.
Alburnus ulanus: Lake Urmia.

Ballerus sapa: Caspian Sea.

Blicca bjoerkna: Caspian Sea.

Chondrostoma cyri: Caspian Sea.
Chondrostoma esmaeilii: Tigris River.
Chondrostoma orientale: Kor River.
Chondrostoma regium: Esfahan, Persis, Tigris River.

Leucaspius delineatus: Caspian Sea.

Leuciscus aspius: Caspian Sea.
Leuciscus vorax: Tigris River.

Pelecus cultratus: Caspian Sea.

Rutilus kutum: Caspian Sea.
Rutilus lacustris: Caspian Sea.

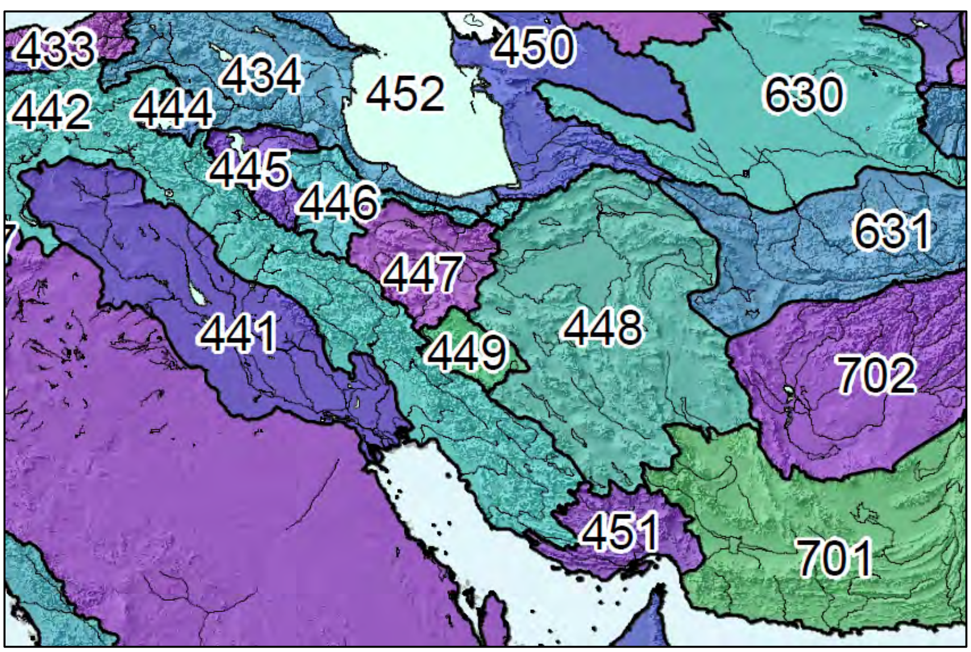
Scardinius erythrophthalmus: Caspian Sea.

Squalius berak: Tigris River.
Squalius latus: Hari River.
Squalius lepidus: Tigris River.
Squalius namak: Dasht-e Kavir, Namak Lake.
Squalius turcicus: Caspian Sea, Lake Urmia.

Vimba persa: Caspian Sea.

The most widely distributed species in terms of basins is *Alburnus sellal* (6 basins), followed by *Acanthobrama persidis* (4). Most species (40 or 85.1%) occur in a single basin with the 5 remaining species in 2-3 basins.

3) Ecoregions with native species content. See Abell *et al*. (2008) for descriptions of ecoregions. Records for the ecoregion Caspian Marine (452) are for fish entering brackish water of the nearshore Caspian Sea.



Ecoregions of Iran, after www.feow.org/ and Abell *et al*. (2008)
(note later versions show some minor boundary modifications).

434, Kura-South Caspian: *Abramis brama*, *Acanthobrama microlepis*, *Alburnoides eichwaldii*, *Alburnoides samiii*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Ballerus sapa*, *Blicca bjoerkna*, *Chondrostoma cyri*, *Leucaspius delineatus*, *Leuciscus aspius*, *Pelecus cultratus*, *Rutilus kutum*, *Rutilus lacustris*, *Scardinius erythrophthalmus*, *Squalius turcicus*, *Vimba persa*.

441, Lower Tigris and Euphrates: *Acanthobrama marmid*, *Alburnoides idignensis*, *Alburnus caeruleus*, *Alburnus sellal*, *Chondrostoma regium*, *Leuciscus vorax*, *Squalius berak*, *Squalius lepidus*.

442, Upper Tigris and Euphrates: *Acanthobrama marmid*, *Acanthobrama persidis*, *Alburnoides idignensis*, *Alburnoides nicolausi*, *Alburnoides qanati*, *Alburnoides* sp., *Alburnus caeruleus*, *Alburnus doriae*, *Alburnus sellal*, *Chondrostoma esmaeilii*, *Chondrostoma orientale*, *Chondrostoma regium*, *Leuciscus vorax*, *Squalius berak*, *Squalius lepidus*.

445, Orumiyeh (= Urmia): *Acanthobrama urmianus*, *Alburnoides petrubanarescui*, *Alburnus ulanus*.

446, Caspian Highlands: *Acanthobrama microlepis*, *Alburnoides samiii*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Vimba persa*.

447, Namak: *Alburnoides namaki*, *Alburnus doriae*, *Squalius namak*.

448, Kavir and Lut Deserts: *Alburnoides coadi*, *Alburnoides damghani*, *Alburnoides qanati*, *Squalius namak*.

449, Esfahan: *Alburnoides* sp., *Alburnus doriae*, *Alburnus sellal*, *Chondrostoma regium*.

450, Turan Plain: *Abramis brama*, *Alburnoides parhami*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus hohenackeri*, *Blicca bjoerkna*, *Leuciscus aspius*, *Rutilus kutum*, *Rutilus lacustris*, *Squalius turcicus*, *Vimba persa*.

451, Northern Hormuz Drainages: *Acanthobrama persidis*.

452, Caspian Marine: *Abramis brama*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Ballerus sapa*, *Blicca bjoerkna*, *Leuciscus aspius*, *Pelecus cultratus*, *Rutilus kutum*, *Rutilus lacustris*, *Vimba persa*.

631, Upper Amu Darya: *Alburnoides holciki*, *Alburnus taeniatus*, *Squalius latus*.

701, Baluchistan: None.

702, Helmand-Sistan: None.

The ecoregion with the most species is the Kura-South Caspian with 19 species (40.4% of all species) followed by the Upper Tigris and Euphrates with 15 species (31.9%), Caspian Marine with 11 species (23.4%) and Turan Plain with 11 species (23.4%). These all represent large areas with diverse habitats. Other ecoregions have one to eight species, two with seven and eight species and six with one to four species. Two of the 14 ecoregions have no leuciscids, being in the most eastern and southeastern parts of the country.

4) Native species distribution in ecoregions, presented in numerical order as above:-

Abramis brama: Kura-South Caspian, Turan Plain, Caspian Marine.

Acanthobrama marmid: Lower Tigris and Euphrates, Upper Tigris and Euphrates.
Acanthobrama microlepis: Kura-South Caspian, Caspian Highlands.
Acanthobrama persidis: Upper Tigris and Euphrates, Northern Hormuz Drainages.
Acanthobrama urmianus: Orumiyeh (= Urmia).

Alburnoides coadi: Kavir and Lut Deserts.
Alburnoides damghani: Kavir and Lut Deserts.
Alburnoides eichwaldii: Kura-South Caspian.
Alburnoides holciki: Upper Amu Darya.
Alburnoides idignensis: Lower Tigris and Euphrates, Upper Tigris and Euphrates.
Alburnoides namaki: Namak.
Alburnoides nicolausi: Upper Tigris and Euphrates.
Alburnoides parhami: Turan Plain.
Alburnoides petrubanarescui: Orumiyeh (= Urmia).
Alburnoides qanati: Upper Tigris and Euphrates, Kavir and Lut Deserts.
Alburnoides samiii: Kura-South Caspian, Caspian Highlands.
Alburnoides sp.: Esfahan.
Alburnoides sp.: Upper Tigris and Euphrates.
Alburnoides tabarestanensis: Kura-South Caspian, Caspian Highlands, Turan Plain.

Alburnus atropatenae: Orumiyeh (= Urmia).
Alburnus caeruleus: Lower Tigris and Euphrates, Upper Tigris and Euphrates.
Alburnus chalcoides: Kura-South Caspian, Caspian Highlands, Turan Plain, Caspian Marine.
Alburnus doriae: Upper Tigris and Euphrates, Namak, Esfahan.
Alburnus filippii: Kura-South Caspian, Caspian Highlands, Caspian Marine.
Alburnus hohenackeri: Kura-South Caspian, Caspian Highlands, Turan Plain, Caspian Marine.
Alburnus sellal: Lower Tigris and Euphrates, Upper Tigris and Euphrates, Esfahan, Northern Hormuz Drainages.
Alburnus taeniatus: Upper Amu Darya.
Alburnus ulanus: Orumiyeh (= Urmia).

Ballerus sapa: Kura-South Caspian, Caspian Marine.

Blicca bjoerkna: Kura-South Caspian, Turan Plain, Caspian Marine.

Chondrostoma cyri: Kura-South Caspian.
Chondrostoma esmaeilii: Upper Tigris and Euphrates.
Chondrostoma orientale: Upper Tigris and Euphrates.
Chondrostoma regium: Lower Tigris and Euphrates, Upper Tigris and Euphrates, Esfahan.

Leucaspius delineatus: Kura-South Caspian.

Leuciscus aspius: Kura-South Caspian, Turan Plain, Caspian Marine.
Leuciscus vorax: Lower Tigris and Euphrates, Upper Tigris and Euphrates.

Pelecus cultratus: Kura-South Caspian, Caspian Marine.

Rutilus kutum: Kura-South Caspian, Turan Plain, Caspian Marine.
Rutilus lacustris: Kura-South Caspian, Turan Plain, Caspian Marine.

Scardinius erythrophthalmus: Kura-South Caspian.

Squalius berak: Lower Tigris and Euphrates, Upper Tigris and Euphrates.
Squalius latus: Upper Amu Darya.
Squalius lepidus: Lower Tigris and Euphrates, Upper Tigris and Euphrates.
Squalius namak: Namak, Kavir and Lut Deserts.
Squalius turcicus: Kura-South Caspian, Caspian Highlands, Turan Plain.

Vimba persa: Kura-South Caspian, Caspian Highlands, Turan Plain, Caspian Marine.

The species are found in one to four ecoregions. Species in three or four ecoregions (29.8%) are those associated with the Caspian Sea in northern Iran and Tigris River and adjacent areas in southwestern Iran, areas of diverse habitat. Twenty species are found in a single ecoregion (42.6%), 13 in two ecoregions (27.7%), ten in three ecoregions (21.3%) and four in four ecoregions (8.5%).

<><><><><>

The following summarises the distribution of native cyprinoids in Iran including four families not dealt with in the current work (see Coad (2018b, 2018c, 2019b, 2019c) for descriptions), i.e., the families Acheilognathidae (*Rhodeus*), Cyprinidae, Danionidae (*Barilius*, *Cabdio*), Gobionidae (*Gobio*, *Romanogobio*), Leuciscidae and Tincidae (*Tinca*).

An asterisk (*) marks endemics which here are endemic to the basin but may include waters outside Iran (in the Caspian Sea, Tigris River and Hari River basins). An octothorpe (#) marks species requiring confirmation of this distribution.

a) Exorheic basins

Hormuz (14, 2 endemics): _Acanthobrama persidis_, _Alburnus sellal_, _Arabibarbus grypus_, _Barbus lacerta_, *_Capoeta anamisensis_, _Capoeta mandica_, _Capoeta saadii_, _Carasobarbus luteus_, _Cyprinion milesi_, _Cyprinion watsoni_, *_Garra_ sp., _Garra persica_, _Garra rufa_,

Luciobarbus barbulus.

Makran (8, 1 endemic): *Cabdio morar, Cyprinion milesi*, *Cyprinion watsoni*, *Garra nudiventris, Garra persica*, **Garra roseae*, *Garra rossica*, *Tariqilabeo diplochilus*.

Persis (former Gulf) (23, 2 endemic): *Acanthobrama persidis*, **Alburnoides* sp., *Alburnus sellal, Arabibarbus grypus*, *Barilius mesopotamicus*, *Barbus lacerta*, **Capoeta ferdowsii*, *Capoeta macrolepis*, *Capoeta mandica*, *Capoeta saadii*, *Capoeta trutta*, *Carasobarbus luteus*, *Carasobarbus sublimus*, *Chondrostoma regium*, *Cyprinion kais*, *Cyprinion macrostomus*, *Cyprinion tenuiradius*, *Garra mondica*, *Garra rufa*, *Luciobarbus barbulus*, *Luciobarbus esocinus*, *Luciobarbus kersin*, *Mesopotamichthys sharpeyi*.

Tigris River (40, 16 endemic): *Acanthobrama marmid*, **Alburnoides idignensis*, **Alburnoides nicolausi*, *Alburnus caeruleus*, *Alburnus doriae*, *Alburnus sellal*, *Arabibarbus grypus*, **Barbus karunensis*, *Barbus lacerta*, *Barilius mesopotamicus*, **Capoeta coadi*, *Capoeta macrolepis*, *Capoeta mandica*, **Capoeta pyragyi*, **Capoeta shajariani*, *Capoeta trutta*, *Capoeta umbla*, **Carasobarbus kosswigi*, *Carasobarbus luteus*, **Carasobarbus sublimus*, **Chondrostoma esmaeilii*, *Chondrostoma regium*, *Cyprinion kais*, *Cyprinion macrostomus*, **Garra amirhosseini*, *Garra gymnothorax*, **Garra lorestanensis*, *Garra rufa*, **Garra tashanensis*, **Garra typhlops*, **Garra variabilis*, *Leuciscus vorax*, *Luciobarbus barbulus*, *Luciobarbus esocinus*, *Luciobarbus kersin*, **Luciobarbus subquincunciatus*, **Luciobarbus xanthopterus*, *Mesopotamichthys sharpeyi*, *Squalius berak*, *Squalius lepidus*.

b) Endorheic basins

Bejestan (3): *Capoeta fusca*, *Cyprinion watsoni*, *Garra rossica*.

Caspian Sea (31, 16 endemics): *Abramis brama*, **Acanthobrama microlepis*, **Alburnoides eichwaldii*, **Alburnoides parhami*, **Alburnoides samiii*, **Alburnoides tabarestanensis*, **Alburnus chalcoides*, **Alburnus filippii*, **Alburnus hohenackeri*, *Ballerus sapa*, *Barbus cyri*, *Blicca bjoerkna*, *Capoeta capoeta*, **Capoeta kaput*, **Capoeta razii*, **Chondrostoma cyri*, *Cyprinus carpio*, *Leucaspius delineatus*, *Leuciscus aspius*, **Luciobarbus capito*, **Luciobarbus caspius*, *Luciobarbus mursa*, *Pelecus cultratus*, *Rhodeus amarus* (under description as a distinct species), *Romanogobio macropterus*, **Rutilus kutum*, *Rutilus lacustris*, *Scardinius erythrophthalmus*, **Squalius turcicus*, *Tinca tinca*, **Vimba persa*.

Dasht-e Kavir (9, 2 endemics): **Alburnoides coadi*, **Alburnoides damghani*, *Barbus miliaris*, *Capoeta aculeata*, *Capoeta buhsei*, *Capoeta fusca*, *Capoeta razii*, *Schizothorax pelzami*, *Squalius namak*.

Dasht-e Lut (5): *Capoeta fusca*, *Capoeta saadii*, *Cyprinion watsoni*, *Garra nudiventris*, *Garra rossica*.

Esfahan (7, 2 endemics): **Alburnoides* sp., *Alburnus doriae*, *#Alburnus sellal*, *Barbus lacerta*, *Capoeta coadi*, **Capoeta gracilis*, *Chondrostoma regium*.

Hamun-e Mashkid (6): *Bangana dero*, *Cabdio morar*, *#Cyprinion milesi*, *Cyprinion watsoni*, *Garra rossica*, *Tariqilabeo diplochilus*.

Hamun-e Jaz Murian (5): *#Capoeta saadii*, *Cyprinion milesi*, *Cyprinion watsoni*, *Garra persica*, *Garra rossica*.

Hari River (11, 1 endemic): *Alburnoides holciki*, *Alburnus taeniatus*, *Capoeta fusca*, **Capoeta heratensis*, *Cyprinus carpio*, *Garra rossica*, *Gobio nigrescens*, *Luciobarbus conocephalus*, *Schizothorax intermedius*, *Schizothorax pelzami*, *Squalius latus*.

Kerman-Na'in (5): *Capoeta buhsei*, *#Capoeta macrolepis*, *Capoeta saadii*, *Cyprinion watsoni*, *#Garra persica*.

Kor River (9, 1 endemic): *Acanthobrama persidis*, *Alburnoides qanati*, *Alburnus sellal*, *Capoeta macrolepis*, *Capoeta saadii*, *#Carasobarbus luteus*, **Chondrostoma orientale*, *Garra rufa*, *Luciobarbus barbulus*.

Lake Maharlu (7): *Acanthobrama persidis*, *Alburnus sellal*, *Barbus lacerta*, *Capoeta saadii*, *Carasobarbus luteus*, *Cyprinion tenuiradius*, *Garra rufa*.

Lake Urmia (9, 4 endemics): **Acanthobrama urmianus*, **Alburnoides petrubanarescui*, **Alburnus ulanus*, *Barbus cyri*, **Barbus urmianus*, *Capoeta capoeta*, *Luciobarbus mursa*, *Romanogobio persus*, *Squalius turcicus*.

Namak Lake (6, 1 endemic): **Alburnoides namaki*, *Alburnus doriae*, *Barbus miliaris*, *Capoeta aculeata*, *Capoeta buhsei*, *Squalius namak*.

Sirjan (4): *Alburnoides qanati*, *#Capoeta buhsei*, *Capoeta saadii*, *Cyprinion watsoni*.

Sistan (10, 3 endemic): *Capoeta fusca*, *Cyprinion watsoni*, *Garra nudiventris*, *#Garra persica*, *Garra rossica*, **Schizocypris altidorsalis*, *Schizopygopsis stolickai*, *Schizothorax intermedius*, **Schizothorax zarudnyi*, **Tariqilabeo adiscus*.

The following summarises distribution of native cyprinoids by ecoregion with the added families noted above.

434, Kura-South Caspian: *Abramis brama*, *Acanthobrama microlepis*, *Alburnoides eichwaldii*, *Alburnoides samiii*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Ballerus sapa*, *Barbus cyri*, *Blicca bjoerkna*, *Capoeta capoeta*, *Capoeta kaput*, *Capoeta razii*, *Chondrostoma cyri*, *Cyprinus carpio*, *Leucaspius delineatus*, *Leuciscus aspius*, *Luciobarbus capito*, *Luciobarbus caspius*, *Luciobarbus mursa*, *Pelecus cultratus*, *Rhodeus amarus* (under description as a distinct species), *Romanogobio macropterus*, *Rutilus kutum*, *Rutilus lacustris*, *Scardinius erythrophthalmus*, *Squalius turcicus*, *Tinca tinca*, *Vimba persa*

441, Lower Tigris and Euphrates: *Acanthobrama marmid*, *Alburnoides idignensis, Alburnus caeruleus, Alburnus sellal*, *Arabibarbus grypus, Barbus lacerta, Barilius mesopotamicus, Capoeta macrolepis*, *Capoeta pyragyi*, *Capoeta shajariani*, *Capoeta trutta*, *Capoeta umbla*, *Carasobarbus kosswigi, Carasobarbus luteus, Chondrostoma regium*, *Cyprinion kais*, *Cyprinion macrostomus*, *Garra amirhosseini, Garra gymnothorax*, *Garra rufa*, *Garra variabilis*, *Leuciscus vorax*, *Luciobarbus barbulus*, *Luciobarbus esocinus*, *Luciobarbus kersin*, *Luciobarbus subquincunciatus*, *Luciobarbus xanthopterus*, *Mesopotamichthys sharpeyi*, *Squalius berak*, *Squalius lepidus*.

442, Upper Tigris and Euphrates: *Acanthobrama marmid*, *Acanthobrama persidis*, *Alburnoides idignensis*, *Alburnoides nicolausi*, *Alburnoides qanati*, *Alburnoides* sp., *Alburnus caeruleus*, *Alburnus doriae*, *Alburnus sellal*, *Arabibarbus grypus*, *Barbus karunensis, Barbus lacerta, Barilius mesopotamicus, Capoeta coadi, Capoeta ferdowsii, Capoeta macrolepis*, *Capoeta mandica*, *Capoeta pyragyi*, *Capoeta saadii*, *Capoeta shajariani*, *Capoeta trutta*, *Capoeta umbla*, *Carasobarbus kosswigi*, *Carasobarbus luteus*, *Carasobarbus sublimus, Chondrostoma esmaeilii*, *Chondrostoma orientale*, *Chondrostoma regium*, *Cyprinion kais*, *Cyprinion macrostomus*, *Cyprinion tenuiradius*, *Garra gymnothorax*, *Garra lorestanensis*, *Garra mondica*, *Garra rufa*, *Garra tashanensis, Garra typhlops*, *Garra variabilis*, *Leuciscus vorax*, *Luciobarbus barbulus*, *Luciobarbus esocinus*, *Luciobarbus kersin*, *Luciobarbus subquincunciatus*, *Luciobarbus xanthopterus*, *Mesopotamichthys sharpeyi*, *Squalius berak*, *Squalius lepidus*.

445, Orumiyeh (= Urmia): *Acanthobrama urmianus*, *Alburnoides petrubanarescui*, *Alburnus ulanus*, *Barbus cyri*, *Barbus urmianus*, *Capoeta capoeta*, *Luciobarbus mursa*, *Romanogobio persus*.

446, Caspian Highlands: *Acanthobrama microlepis*, *Alburnoides samiii*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus filippii*, *Alburnus hohenackeri*, *Barbus cyri*, *Capoeta razii*, *Luciobarbus capito*, *Luciobarbus mursa*, *Vimba persa*.

447, Namak: *Alburnoides namaki*, *Alburnus doriae*, *Barbus miliaris*, *Capoeta aculeata*, *Capoeta buhsei*, *Squalius namak*.

448, Kavir and Lut Deserts: *Alburnoides coadi*, *Alburnoides damghani*, *Alburnoides qanati*, *Barbus miliaris*, *Capoeta aculeata*, *Capoeta buhsei*, *Capoeta fusca*, *Capoeta macrolepis*, *Capoeta razii*, *Capoeta saadii*, *Cyprinion watsoni*, *Garra nudiventris*, *Garra persica*, *Garra rossica*, *Schizothorax pelzami*, *Squalius namak*.

449, Esfahan: *Alburnoides* sp., *Alburnus doriae*, *Alburnus sellal*, *Barbus lacerta*, *Capoeta coadi*, *Capoeta gracilis*, *Chondrostoma regium*.

450, Turan Plain: *Abramis brama*, *Alburnoides parhami*, *Alburnoides tabarestanensis*, *Alburnus chalcoides*, *Alburnus hohenackeri*, *Blicca bjoerkna*, *Barbus cyri*, *Capoeta razii*, *Cyprinus carpio*, *Leuciscus aspius*, *Luciobarbus capito*, *Luciobarbus caspius*, *Luciobarbus mursa*, *Rhodeus amarus* (under description as a distinct species), *Rutilus kutum*, *Rutilus lacustris*, *Squalius turcicus*, *Tinca tinca*, *Vimba persa*.

451, Northern Hormuz Drainages: *Acanthobrama persidis, Capoeta anamisensis, Capoeta mandica, Capoeta saadii, Cyprinion milesi, Cyprinion watsoni, Garra persica, Garra rufa, Garra* sp.

452, Caspian Marine: *Abramis brama, Alburnus chalcoides, Alburnus filippii, Alburnus hohenackeri, Ballerus sapa, Blicca bjoerkna, Cyprinus carpio, Leuciscus aspius, Luciobarbus capito, Luciobarbus caspius, Luciobarbus mursa, Pelecus cultratus, Rutilus kutum, Rutilus lacustris, Vimba persa*.

631, Upper Amu Darya: *Alburnoides holciki, Alburnus taeniatus, Capoeta fusca, Capoeta heratensis, Cyprinus carpio, Garra rossica, Gobio nigrescens, Luciobarbus conocephalus, Schizothorax intermedius, Schizothorax pelzami, Squalius latus*.

701, Baluchistan: *Bangana dero, Cabdio morar, Capoeta saadii, Cyprinion milesi, Cyprinion watsoni, Garra nudiventris, Garra persica, Garra roseae, Garra rossica, Tariqilabeo diplochilus*.

702, Helmand-Sistan: *Capoeta fusca, Cyprinion watsoni, Garra nudiventris, Garra persica, Garra rossica, Schizocypris altidorsalis, Schizopygopsis stolickai, Schizothorax intermedius, Schizothorax zarudnyi, Tariqilabeo adiscus*.

Species Accounts

Introduction

The leuciscids or minnows are found in North America, North Africa, Europe and northern Asia and are absent in southern or sub-Saharan Africa and southern Asia. There are about 674 species (*Catalog of Fishes*, downloaded 31 January 2019).

The relationships of this family are given Volume I. The family is defined by molecular characters and by some morphological characters in combination and with exceptions between genera and across families. Generally, minnows in Iran lack barbels and fin spines and fin denticles, lips are not fleshy, mouths are not arched with a horny lower lip nor do they have a ventral adhesive disc on the chin, they have a short dorsal fin (often 8 dorsal fin branched rays), the anal fin can be short or long (7-44 branched rays), scales are small to large, enlarged scales around the vent and anal fin are not present, a ventral scaleless keel may be present (e.g., *Alburnus*), they are often relatively small in size (under 10.0 cm total length in *Alburnoides* spp.), pharyngeal teeth are in one or two rows (usually two rows with common formulae being 2,5-4,2 or 2,5-5,2, and polyploidy is not present. Bogutskaya (1991) gave additional, osteological characters although the limits of leuciscines (or Leuciscidae) have changed since that work.

Recent major changes in taxonomy involving species found in Iran include the synonymy of such genera as *Acanthalburnus* with *Acanthobrama* and *Aspius* with *Leuciscus*. Members of the genus *Squalius* were formerly in the genus *Leuciscus*. Readers consulting older literature should be aware that species may appear under these older genera. Species biology discussed in this text may well appear under the more recent name, not the older one that appears in the literature source.

Saadati (1977) recorded a *Pseudophoxinus* species from Kermanshah, Bid Sorkh River between Sahneh and Kangavar in the Gamasiab River basin (ca. 34°23’N, ca. 47°52’E) but this material has been lost and was probably a misidentification.

Some species may enter brackish water but the family is primarily a freshwater one. Many of the morphological and biological features of minnows are the same as in carps and are shared with other cyprinoids (see Cyprinidae, Volume I). This general treatment of cyprinoids is not repeated here.

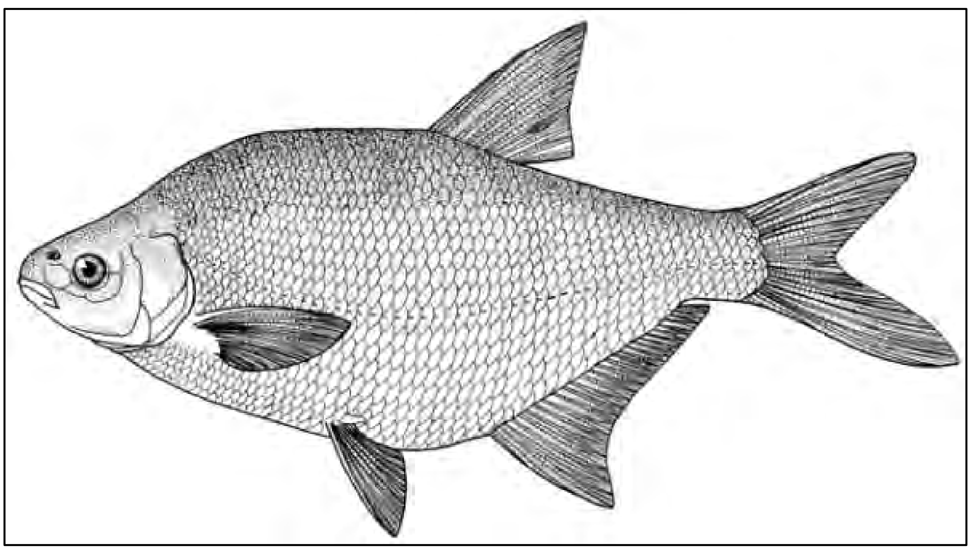
Genus *Abramis*
Cuvier, 1816

The bream genus comprises a single species found in Europe, Asia Minor and the Caspian and Aral Sea basins. *Ballerus sapa* was once included in this genus as were species in the genera *Blicca* and *Vimba* (*q.v.*), also found in Iran.

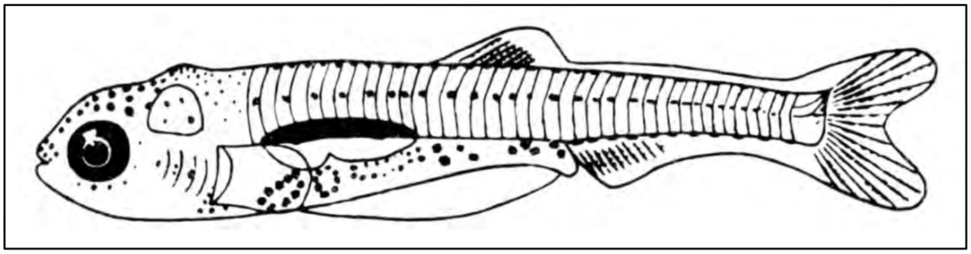
The genus is characterised by a strongly compressed and deep body, a scaleless keel between the vent and pelvic fins, a scaleless groove on the back in front of the dorsal fin but not behind the fin, pharyngeal teeth in one row, compressed and with a groove on the grinding surface, dorsal fin short and spineless, anal fin very long, and lateral line decurved.

Durand *et al*. (2002a, 2002b) studying cytochrome *b* data concluded that this genus is not monophyletic since *A. ballerus* and *A. sapa* (= *Ballerus sapa*) are placed basal to a group of species including *A. brama*, *Blicca bjoerkna*, *Vimba* species, *Acanthalburnus* (= *Acanthobrama*) *microlepis* and *Acanthobrama*. Perea *et al*. (2010) found this genus to be distinct and part of a lineage also including the genera *Acanthobrama*, *Acanthalburnus* (= *Acanthobrama*), *Ballerus*, *Blicca*, *Mirogrex* (of the Levant) and *Vimba* together with *Petroleuciscus* (= *Acanthobrama*) *persidis*. This genus is recognised here as distinct from the related genera *Ballerus*, *Blicca* and *Vimba* after Bogutskaya and Naseka (2004) and Kottelat and Freyhof (2007) although Parin *et al*. (2014) disagreed with this interpretation.

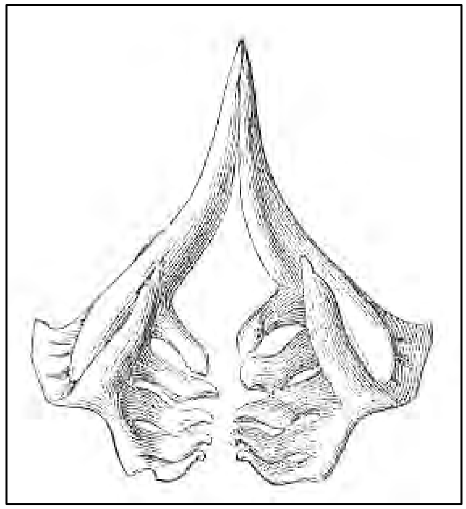
Abramis brama
(Linnaeus, 1758)



Abramis brama
S. Laurie-Bourque @ Canadian Museum of Nature.



Abramis brama fry, 9.2 mm, 14 days, Russia, Volga River delta, after Kazanskii (1915).



Abramis brama, pharyngeal teeth, after Seeley (1888).

Abramis brama, Gilan, Anzali Shore, June 2012, Keyvan Abbasi.

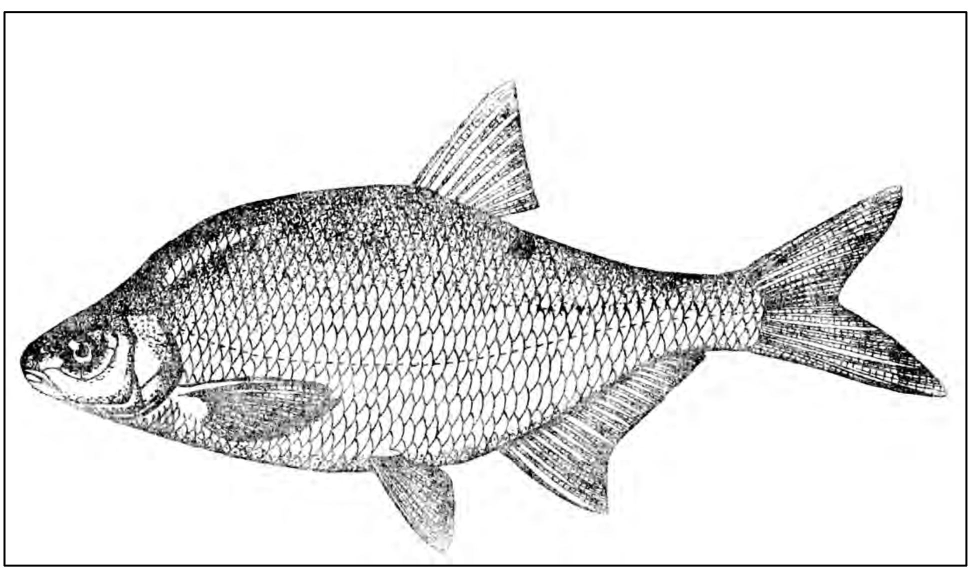
Abramis brama, aquarium fish
(Carp bream1, CC0, image rotated and background cleaned, Mikova Natalia (*sic*)).

Common names. Sim or seam (= silver), mahi-ye sim (= silver fish).

[Capag, chakag, chapakh or chipakh, all in Azerbaijan; gundogar tarany (topi) in Turkmenian; Çapak balığı, tahta balığı in Turkish (Çiçek *et al*., 2020); vostochnyi leshch or Oriental bream in Russian; common, bronze, carp or eastern bream; sea bream from Bozorgnia *et al*. (2016)].

Systematics. *Cyprinus Brama* was originally described from Sweden. A syntype of *Cyprinus brama* is in the Natural History Museum, London as a skin under BM(NH) 1853.11.12:147 (Eschmeyer *et al*., 1996).

Abramis brama orientalis Berg, 1949 is reported for the Caspian Sea (Lake Yashkan in Uzboi) and Aral Sea (Aral Sea at Muinak (not Muinsak as in the *Catalog of Fishes*, downloaded 15 May 2018) basins but Koshara and Izyumov (1991) restricted this subspecies to the Aral Sea with the type subspecies in the Caspian Sea basin. They did not examine any Iranian material. Kozhara and Mironovskiy (1988) using numbers of pores in the seismosensory canals for samples taken over a wide range of this species identified eight population groups but did not recognise subspecies. Some earlier works also indicated that no subspecies exist (see Reshetnikov *et al*., 1997).



Abramis brama orientalis, after Abdurakhmanov (1962).

Abramis brama bergi Grib and Vernidub, 1935 (objectively invalid; preoccupied by *Abramis sapa bergi* Belyaeff, 1930 according to Eschmeyer *et al*. (1996) and *Catalog of Fishes* (downloaded 15 November 2015)) was originally described from the Aral Sea at Muinak and Lake Yashkan in the Uzboi Valley of Turkmenistan, the latter north of the Iranian border (Berg, 1948-1949). It was replaced by *Abramis brama orientalis*.

Caspian material reportedly has more gill rakers, fewer vertebrae and fewer scales than the type subspecies from the Baltic Sea basin (Berg, 1948-1949) but further study over the whole range of the species is needed to clarify the situation, analyzing for clines, and specific distinctions. The Iranian populations are referred to the type subspecies for the moment. A molecular study would be apposite.

Khara (2006) and Khara *et al*. (2007, 2007, 2008) compared fish from the Anzali Wetland and the Caspian Sea, the Caspian Sea and Aras Dam, and Azerbaijan Republic coast fish and Aras Dam, meristically, morphometrically and genetically. Significant differences were noted in particular for morphometric characters in the first comparison and morphometrically and meristically in the second. These differences were attributed to differing habitats and environmental conditions. Azerbaijan fish had more genetic diversity than Aras Dam fish and were significantly different. Ghasemi *et al*. (2007) used five microsatellite loci in comparing Iranian and Azeri bream and found Iranian stocks had reduced genetic variability attributed to inbreeding and genetic drift. Khara *et al*. (2009) compared fish from the Anzali Wetland and the southern coast of the Caspian Sea in Iran and the southwest coast in Azerbaijan using mtDNA. The greatest genetic diversity was found in Azerbaijan which was significantly different from the Iranian samples, which were not themselves significantly different. Zeinab *et al*. (2015) examined genetic polymorphism using seven microsatellite loci on the Chamkhaleh and Bandar-e Anzali coasts and found allele frequency had declined due to inbreeding and genetic drift, and the populations lacked a desirable level of genetic diversity. Hosseinnia *et al*. (2016) using the same methods and localities came to the same conclusion.

Artificial hybrids with *Rutilus frisii kutum* (= *R. kutum*) and *Rutilus rutilus* (may involve *R. lacustris*) have been bred in Iran (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, pp. 39-40, 1996).

Key characters. The scaleless keel on the belly, deep body, high number of branched rays in the anal fin (22-30), modally 9 dorsal fin branched rays, and uniserial pharyngeal teeth are key characters.

Morphology. The body is very deep and compressed, being deepest at the dorsal fin origin. A nuchal hump develops in larger fish and the head is set off from the predorsal profile. The predorsal profile is convex with a strong dorsal ridge. The caudal peduncle is compressed and is moderately deep. The rear of the eye is at the beginning of the anterior half of the head. The snout is very rounded. The mouth is small, subterminal and oblique but highly protrusible and extends back to the level of the nostril. Lips are of moderate thickness. The dorsal fin margin is straight or emarginate. The dorsal fin origin is posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the middle of the anal fin. The caudal fin is deeply forked with rounded tips. The lower lobe of the caudal fin is larger than the upper lobe. The anal fin is very emarginated anteriorly and then has a gradual straight decline in height. The anal fin does not extend back to the caudal fin base. The pelvic fin is rounded and may almost extend to, or reaches, the anal fin origin. The pectoral fin is rounded and may extend to the pelvic fin origin or fall short.

Dorsal fin unbranched rays 3 and branched rays 8-10, usually 9, anal fin unbranched rays

3 and branched rays 22-30, pectoral fin branched rays 16-17, and pelvic fin branched rays 8. Lateral line scales 48-60. The lateral line is moderately decurved. Scales are regularly arranged, sheathing the anal fin base. There is a pelvic axillary scale. Scale shape is squarish to rounded with a rounded posterior margin, a straight to rounded dorsal margin, a more rounded ventral margin and an anterior wavy margin with 2-4 protrusions. Anterior scale corners are rounded. Scales have numerous fine circuli but only relatively few posterior and even fewer anterior radii. In a fish about 6.0 cm long there are as few as 8 total radii. The focus is almost central. The ventral keel between the pelvic fin bases and the anal fin is well-developed. Total gill rakers number 18-30, are short, and reach the raker below when appressed. They are strongly tuberculate on the inner surface. The pharyngeal tooth formula is modally 5-5, with variants of 6-5 (2.2-4.8%), 5-4 (2.2-4.4%) and 4-5 (8.6%) for collections from the Caspian and Aral seas basins in former Soviet waters (Vasil'yeva and Ustarbekov, 1991). Other variants are summarised in Tadajewska (1998). Teeth bear a small hook at the tip in the main row and have long, narrow and flat crowns. In young fish, the hook is more pronounced and the crown has a few tubercles or a series of serrations. Total vertebrae number 38-47, usually 42-44 in the Caspian populations (lower counts in literature may not include four Weberian vertebrae). The gut is s-shaped with a small anterior loop. The chromosome number is 2n = 50-52 (Klinkhardt *et al*., 1995). The chromosome number based on fish from the Iranian coast of the Caspian Sea is 2n = 50 with the number of arms NF = 82 and the karyotype being eight pairs of metacentric, eight pairs of sub-metacentric and nine pairs of acrocentric chromosomes (Nahavandi *et al*., 2001).

Bani *et al*. (2015) gave details of larval development. Vakili *et al*. (2020) described the morphological characteristics of otoliths of fish from Fereydun Kenar.

Meristic values for Iranian specimens are:- dorsal fin branched rays 9(12) or 10(1), anal fin branched rays 24(3), 25(3), 26(1), 27(4) or 28(2), pectoral fin branched rays 16(7) or 17(6), pelvic fin branched rays 8(13), lateral line scales 49(2), 50(2), 51(3), 52(3), 54(1) or 55(2), total gill rakers 23(3), 24(2), 25(6), 26(1) or 27(1), pharyngeal teeth 5-5(12), and total vertebrae 44(12) or 45(1).

Sexual dimorphism. Males bear tubercles on the head, body and fins. Scale tubercles appear singly, in pairs or occasionally as three per scale. There is some evidence of differences in gill raker counts between the sexes but sometimes the males have higher mean counts and sometimes the females. Abdurakhmanov (1962) reported eye diameter, greatest body depth and predorsal distance to be greater in females and dorsal fin base length, pectoral and pelvic fin lengths and interorbital width to be greater in males from Azerbaijan.

Colour. In Dagestan, the resident form is darker in colour than the semi-anadromous form (Shikhshabekov, 1969). Overall colour is silvery. The iris is silvery with a little grey pigment on the upper part. The dorsal and caudal fins are pale grey, almost transparent, to a greyish-blue, the pectoral fins may be grey or colourless, or reddish, and pelvic fins are colourless to reddish mesially and blackish distally. All fins except the pectorals have black tips. Large fish are a dark olive-green on the back and bronze on the flanks and old fish may have all fins black. The peritoneum is silvery to light brown in preserved fish.

Size. Attains 90.0 cm total length and 11.55 kg, possibly 1.0 m and 16.4 kg (Machacek (1983-2012), downloaded 27 July 2012).

Distribution. Found from the British Isles across Europe north of the Pyrenees and Alps eastwards to the Black, Caspian and Aral Sea basins although not in western Transcaucasia. In Iran, this species is found in the Caspian Sea basin from the Astara to the Atrak rivers including

the Aras, Babol, Behambar, Fereydun Kenar, Golshan, Gorgan, Haraz, Langarud, Pesikhan, Polrud (= Pol-e Rud), Qareh Su, Rasteh, Sefid, Shah, Shalman, Sheikan and Talar rivers, the Astara Talab, Gorgan Bay, the Anzali Talab and its shore, outlets and tributaries (such as the Nahang and Pir Bazar rogas and Siah Darvishan River), the Amirkelayeh Wetland and the Siahkeshim Protected Region, freshened areas of the Caspian Sea, Alagol Lake, and the Alagol, Khoda Afarin and Aras dams (Kozhin, 1957; Holčík and Oláh, 1992; Riazi, 1996; Kiabi *et al*., 1999; Nasrollahzadeh, 1999; Abbasi *et al*., 2007, 2017; Khara *et al*. 2007; Zareh Reshquoeeieh *et al*., 2016; Babaei *et al*., 2017; Mazandarani *et al*., 2018, 2019). It is introduced to the Mahabad River and Dam and the Shahr and Zarrineh rivers of the Lake Urmia basin (Mirhasheminasab and Pazooki, 2003; Abbasi *et al*., 2005; Ghasemi *et al*., 2015; Jouladeh-Roudbar *et al*., 2020). Rasouli *et al*. (2011) reported it from Marmisho Lake, west of Urmia.

This species is also recorded from the Karakum Canal and Kopetdag Reservoir in Turkmenistan (Shakirova and Sukhanova, 1994; Sal'nikov, 1995) and may eventually reach Iranian waters in the Hari River basin from the Tedzhen River where it has been reported by Aliev *et al*. (1988).

Zoogeography. This species is part of a northern European and northern Southwest Asian fauna. Its origins may lie in a Danubian or Sarmatian fauna.

Habitat. This species is found in rivers, streams, dams, lagoons, and brackish environments. The bream prefers still water and is low in numbers even in rivers with weak current. Abundant littoral vegetation and a very muddy bottom are favoured in lakes for reproduction and feeding respectively. It retreats to deeper water in winter, forming schools numbering in the many thousands, packed densely together (Muus and Dahlstrøm, 1999). Berg (1948-1949) gave details of biology in the Volga and North Caspian Sea and elsewhere and there have been numerous studies since then not summarised here.

It was more numerous in the Anzali Talab along the Caspian coast of Iran (Naderi Jolodar and Abdoli, 2004). This species can tolerate high temperatures of 33-34°C in southern areas like Iran for a time but above 28°C growth rate decreases. Adults can live in a salinity of 12.9‰, perhaps 14‰, and eggs may be fertilised at a salinity of 10.2‰. However, preferred levels are 2-4‰. Salinity and water level changes have significant effects on abundance in this species. Population densities vary markedly in both fresh and brackish water populations.

Bream living in the Caspian Sea basin are semi-migratory. They feed in the brackish sea but spawn and winter in the lower reaches and deltas of large rivers. A spring migration up rivers begins with ice melt or warmer temperatures in the sea and after spawning the fish return to disperse and feed in the sea. In the fall the fish migrate into the deeper parts of river deltas. In Russian parts of the Caspian, they are found at depths not exceeding 4-5 m but Knipovich (1921) reported them at 14.6-16.5 m, possibly deeper, in the Iranian Caspian Sea.

There are spring and winter migrants in the southwestern Caspian including the Anzali Talab (as "Bay of Murdab" from A. M. Shukolyukov in Berg, 1948-1949). The spring bream have a longer snout, deeper head, lower body, lower dorsal and anal fins, and more scales. The spring bream enter the talab for spawning only while the winter bream overwinters in bottom pools. Changing conditions in the talab environment in the late 1980s and the 1990s may have altered this migration. Riazi (1996) reported that this species migrates into the Siahkeshim Protected Region of the Anzali Talab.

Age and growth. Most fish examined by Razivi *et al*. (1972) from commercial catches in Iran were 3-6 years old, 25.6-39.8 cm long and weighed 249-950 g. Over a three-year period, there was a decline in average age. Young and immature fish formed most of the catch in 1998-

1999 when one-year-old fish comprised 20.3% and two-year-old fish 37.3%. The average length, weight and age for 1998-1999 were 22.5 cm, 212.2 g and 2.4 years. The rate of recruitment was 4.6% in 1991 and 2.7% in 1992 (Saiad Borani, 2001). Abdolmalaki (2005) studied Caspian Sea fish from Iran and found mean fork length, weight and age to be 21.7 cm, 191 g and 2.72 years, respectively. The length-weight relationship was $W = 0.2312L^{2.9}$ and von Bertalanffy growth parameters were $L_t = 45[1\text{-exp-}0.125(t\ 2.768)]$, and the instantaneous rate of total (Z), natural (M) and fishing mortality (F) were 0.92 $year^{-1}$, 0.28 $year^{-1}$ and 0.64 $year^{-1}$, respectively. The exploitation rate (E) was 0.7. Biomass was calculated as 46.362 t and the maximum sustainable yield was 14.99 t. Khara (2006) examined 120 fish from the Anzali Wetland and 90 fish from the Caspian Sea and found bream were up to 5^+ years of age, while 110 Aras Dam bream reached 7^+ years and 125 Azerbaijan bream 9^+ years.

The resident form in Dagestan was slightly inferior in length (2-3 cm), weight and age to the semi-anadromous form (Shikhshabekov, 1969). In Dagestan, the resident form became sexually mature at 3 years for females and 2 years for males at lengths of 23-26 cm and weights of 200-240 g while the semi-anadromous form matured at 4 years and a length of at least 25-28 cm and a weight of 250-300 g. In Uzbekistan females matured at lengths ranging from 10.5 to 27 cm in different reservoirs, usually at age 3 (Kamilov, 1994). Maturity is attained at a younger age in southern waters generally in this species and this probably applies in Iran. The maturity range is 2-10 years with males often maturing a year earlier than females. Females predominate in the older age groups.

Maximum age exceeds 32 years although in southern waters the maximum age does not exceed 15 years. Semi-migratory bream of the Caspian Sea have a fast growth rate and a short life cycle, reaching 37.5 cm standard length by age 8.

Food. Young fish feed on zooplankton. Adults use a strong sucking power and a tube-like snout to feed on invertebrates and detritus in mud. This sucking action leaves evident bream pits in soft mud, depressions about 10 cm across. In the northern Caspian Sea food items include Cumacea, Corophiidae, the clams *Adacna* (69% by weight) and *Monodacna*, Tendipedidae (= Chironomidae), Polychaeta, Gammaridae, Mysidae, and Oligochaeta. When overcrowded or in turbid conditions, plankton may be eaten in addition to the normal foods (Muus and Dahlstrøm, 1999). Large specimens may feed on small fishes. A specimen from the Langarud, Gilan, 158.6 mm standard length, CMNFI 1971-0343, contained chironomids.

Gilan, Langarud at Kheshti Bridge (Kheshti (1), CC BY-SA 4.0, Elaheabed).

Reproduction. Bream enter the Anzali Talab, the main spawning area in the southern Caspian, in the first half of March until the beginning of May. Males precede females on the spawning ground by about three days and males outnumber females by about 3:1. Spawning begins in the first half of April in shallow water and lasts until mid-May.

Bream entered the Kura River from December to February with a peak in January (Berg, 1959) and travelled some distance upriver. These fish had an average length of 31.1 cm and an average weight of 633 g. Length and weight in Azerbaijan varied from 25.4 to 31.9 cm and 306 to 681 g. Fecundity in Dagestan reservoirs reached 191,000 eggs (Shikhshabekov, 1969), in Uzbekistan reservoirs 772,000 eggs (Kamilov, 1994) and a maximum elsewhere of 941,000 yellowish eggs was reported. Bream spawn repeatedly with different partners and although most bream spawn only once a year, multiple spawnings are known. Spawning occurs in masses over a period of 2-3 days triggered by temperatures of 12-13°C or above. The commonest spawning temperature for the species overall is 16-18°C. Spawning is most intensive at night in some populations while others show late morning and late afternoon peaks. There is much splashing of the water by their tails and the noise could be heard some distance away although the fish are easily scared into deeper water by any noise like human voices. Males probably defended territories, attracting females and scaring other males away. There could be up to 2.3 million eggs per sq m however, suggesting that many fish spawned in the same area. Eggs were deposited in quiet water, most commonly at depths of 20-80 cm, and they adhered to aquatic plants or flooded land plants. Eggs were up to 1.9 mm in diameter.

Parasites and predators. Jalali and Molnár (1990a) recorded the monogenean *Dactylogyrus zandti* from this species in the Sefid River. Sattari and Faramarzi (1997a, 1997b) recorded *Caryophyllaeus fimbriceps* from 28% of bream in the Anzali Lagoon. Naem *et al*. (2002) found the monogenean trematodes *Dactylogyrus zandti* and *D. wonderi* on the gills of this species from the western branch of the Sefid River. Sattari *et al*. (2004, 2005) surveyed this species in the Anzali Wetland, recording *Raphidascaris acus* larvae. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G. elegans* from fish in the Sefid River. Masoumian *et al*. (2005) reported the protozoan parasites *Ichthyophthirius*

multifilis and *Trichodina perforata* from this species in the Aras Dam in West Azarbayjan. Masoumian (2007) reported on parasites from fishes in the Aras, Ghotor and Zangbar rivers in West Azarbayjan including *Diplozoon megan*. Pazooki *et al*. (2007) recorded various parasites from localities in West Azarbayjan Province, namely *Ligula intestinalis*, *Digramma* sp., *Argulus foliaceus* and *Caryophyllaeus laticeps*. Sattari *et al*. (2007) recorded the cestode *Caryophyllaeus fimbriceps* (but see Barčák *et al*. (2017) who indicated this needs confirmation), the digenean *Diplostomum spathaceum* and the monogeneans *Dactylogyrus extensus* and *Gyrodactylus* sp. in this species in the Anzali Wetland of the Caspian shore and also mentioned that the monogenean *Diplozoon* sp. is also known from this species in the Iranian Caspian Sea. Barzegar *et al*. (2008) recorded the digenean eye parasite *Diplostomum spathaceum* from this fish. Nezafat Rahimabadi *et al*. (2008) recognised *Trichodina* sp., *Gyrodactylus* sp., *Dactylogyrus* sp., *Diplostomum* sp. and *Ligula intestinalis* in fish from Aras Dam. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea* sp. on this species. Hayatbakhsh *et al*. (2011) found the following parasites from fish on the Anzali coast, *Diplostomum spathaceum*, *Trichodina* sp., *Ligula intestinalis* and *Caryophyllaeus alticeps* and provided data on prevalence, intensity and abundance. *Listeria* contaminates fish from Urmia markets (Modaresi *et al*., 2011), this cyprinid having the highest prevalence of seven fish and crustaceans examined. This bacterium could cause serious disease in humans with a mortality rate at about 20%. Rasouli *et al*. (2011) found the crustacean *Argulus foliaceus* on fish from Marmisho Lake west of Urmia. Hayatbakhsh *et al*. (2012, 2014) recorded *Caryophyllaeus laticeps* and *Ligula intestinalis* (cestodes), *Diplostomum spathaceum* (platyhelminth) and *Trichodina* sp. (ciliophore), these infections reducing haematocrit, mean cell volume and lymphocytes, and increasing white blood cells, mean cell haemoglobin concentration and neutrophils. Ahmadiara *et al*. (2013) described the rate of infection of the cestode *Digramma interrupta* in fish from the Aras Dam and Bandar-e Anzali. Azadikhah *et al*. (2013) found the cestode *Ligula intestinalis* had a high infection rate (mean 67.5%) in fish from the Aras Dam, noting that this parasite is major threat to natural and farmed fish populations. Azizi *et al*. (2013, 2013) found the protozoans *Trichodina* sp., *Chilodonella* sp., *Ichthyobodo* sp. and *Ichthyophthirius* sp. and the monogeneans *Gyrodactylus* sp. and *Diplozoon paradoxus* in fish from the Anzali Talab, with more parasites in the polluted area of the Pir Bazar River. Rasouli (2013) found the digenean *Diplostomum spathaceum* in fish from Caspian drainages in West Azarbayjan. This parasite causes secondary infections as the metacercariae penetrate the skin and eye, lesions, appetite loss, blurry vision and reduced feeding. Bozorgnia *et al*. (2016) showed infection of, and consequent anatomical changes in, gonads, liver and kidney from *Ligula intestinalis* in fish caught at Babolsar, Mazandaran. Omidvar *et al*. (2017) examined 300 juveniles, produced at the Shahid Ansari Hatchery Center of Rasht, Gilan for introduction to the Anzali Wetland, for metacercariae of the *Diplostomum spathaceum* eye parasite and found the frequency of infection was 12.33%, the mean infection was 18.33 and the range rate was 1-4, although no fish showed blurred eye lenses. Mazandarani *et al*. (2018) recorded the cestode *Ligula intestinalis* from fish in the Alagol Lake and Gorgan River. Mazandarani *et al*. (2019) found fish from Alagol Dam in Golestan had the abdominal parasites *Anisakis simplex* and *Eustrongylides excisus* (nematodes) and *Asymphyllodora tinca* and *Pronoprymna ventricosa* (trematodes). The nematodes are zoonotics and a health hazard for consumers. Moumeni *et al*. (2020) also recorded the zoonotic *Anisakis simplex* from this fish in Iran.

The Caspian seal, *Pusa caspica*, is a predator on this species (Krylov, 1984). Various predatory fishes take bream including *Huso huso*, *Perca fluviatilis*, *Sander lucioperca* (pike-perch), *Aspius* (= *Leuciscus*) *aspius* and *Silurus glanis* (European catfish) but this is

comparatively rare especially when bream exceed 20 cm in length. Birds such as grebes, herons, divers and cormorants are also predators. Ashoori *et al*. (2017a) recorded this species as an occasional item in the diet of young black-crowned night herons (*Nycticorax nycticorax*)) in the Anzali Wetland.

Economic importance. This species is an important food fish being both tasty and of large size. In addition, it can live out of water for some time and thus remain fresh while being transported to market. Khanipour (2016) described the production of fish protein concentrate from Anzali Wetland catches, prepared as fish patties. Shoghi *et al*. (2021) replaced wheat flour with bream fish powder in pasta and demonstrated decreased cooking time (13.30 min) and increased cooking loss (8.2%) compared with the wheat flour control pasta. However, except for the 20% level, all pasta protein samples were in the acceptable range (8 g/100 g) for cooking loss. Thus, pasta fortified with fish powder has the potential to be a technological alternative for the food industry to provide protein enriched pasta.

Nevraev (1929) gave catches for various fishing regions in Iran in the early twentieth century. For the Anzali region from 1901-1902 to 1913-1914 the catch was 2,283 to 419,117 individuals, for the Sefid River region from 1908-1909 to 1917-1918 the catch was 17,195 to 474,200 individuals (rising steadily but falling in 1917-1918) with no fish reported in the years 1899-1900 to 1907-1908 and in 1918-1919, and in the Astrabad (= Gorgan) region from 1900-1901 to 1912-1913 the catch was 20,600 to 1,381,500 individuals with no clear trend, the catches varying markedly from year to year. The commercial catch in Iran from 1956/1957 to 1961/1962 varied from 0 to 158 kg (Vladykov, 1964), from 1965/66 to 1968/69 varied from 0 to 29 tonnes (Andersskog, 1970) and from 1963 to 1967 from 0.5 to 16.0 tonnes (with no reported catch in the first three years) (RaLonde and Walczak, 1970b). The catch in the Bandar-e Anzali region from 1933/34 to 1961/62 varied between only 2 kg and over 1,394 t with some years reporting no catches. Holčík and Oláh (1992) reported a catch of 34 kg in the Anzali Talab for 1990 and for the period 1932-1964 catches ranged from none to 1,133.5 tonnes annually. The total catch of the Northern Shilat (Fisheries Company) from 1965/66 to 1968/69 varied between 13 and 74 t (RaLonde and Walczak, 1972). There are obviously wide variations in annual catches and/or in reporting statistics. The general trend is one of decline in catches with large fish being caught and the average stock size being lowered, resulting in a decreased spawning success. This species has a deep body and immature fish are easily caught. The catch in the Anzali Talab was important until the end of the 1940s but had virtually disappeared by the 1980s (Petr, 1987). Abdolmalaki (2005) gave a total catch of 17 t for the 2000-2001 fishing season, only 0.1% of the commercial catch in Iranian coastal waters of the Caspian Sea. In contrast, the total catch for Iranian waters was estimated at 26.3 tons of which 15.4 tons was from beach seines; most fish were immature and undersized (Abdolmalaki, 2006a). Khara (2006) cited a catch of 20 t from the Gilan coast and Anzali Wetland.

In former Soviet waters of the Caspian Sea, the age composition in commercial catches was 2-10 years, with the great majority being 3-5 years old. Trawls, seines, pound nets and gill nets were used in the northern Caspian Sea to catch the bream with 60-70% being taken in spring. Spawning and breeding farms were established in the former Soviet Union to rear young fish. Catches in the Volga-Caspian and Ural regions has been as high as 344,900 centners, prior to 1930, and in the Aral Sea in 1931 the catch was 115,200 centners.

The roe or eggs of this species have been implicated in poisoning (Halstead, 1967-1970; Coad, 1979) and should be avoided (see under the cyprinid genus *Schizothorax* for more information on egg poisoning). Fish should be carefully cleaned in the spawning season to

remove the eggs and ensure against contamination of flesh. Severe cases of egg poisoning in other species have resulted in death. Conversely, Adeli and Namdar (2015) mentioned the eggs of this species as a caviar substitute.

Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use as food and in aquaculture.

Experimental studies. This species has been used in Iran for pollution studies, e.g., on the toxicity and LC_{50} of phenol and 1-naphthol (Shariati *et al*., 2004, 2005), being less vulnerable than *Rutilus kutum* to these compounds. Babaei and Khodaprast (2016) and Babaei *et al*. (2017) examined fish from the Amirkelayeh Wetland and found levels of cadmium, chromium, copper, lead and zinc were within allowable standards in muscle tissue. Jaddi *et al*. (2016) found that the pesticide diazinon in sublethal amounts in Iranian waters affected fingerling survival as indicated by haematological parameters. Safahieh *et al*. (2018) found the LC_{50} 96 h of the pesticide diazinon was 7.316 mg/l, the maximum acceptable toxicant concentration was 0.073 mg/l, the lowest observed concentration effect was 2.63 mg/l, and this species was more resistant than others. Ettefaghdoost and Alaf Noveirian (2020a) measured the bio-accumulation of eleven elements (As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Zn) in muscle tissue of fish captured from the Siah Darvishan River and found only arsenic, cadmium, lead and manganese were at levels higher than approved standards.

Hashemi Kaverdi *et al*. (2017) studied the effects of the using the herb silymarin derived from the milkthistle plant (*Silybum marianum*) in the diet of fry on biochemical parameters of the blood and the immune system, finding strengthening of both. Khomami (2017) studied the effects of the dietary probiotic *Pediococcus acidilactici* on haematological parameters of fry finding increased blood parameters related to red blood cells, disease resistance and improved non-specific immune response. Shoghi *et al*. (2019) replaced wheat flour with bream fish powder in pasta making and found increased protein and lipid, decreased cooking time, and increased cooking loss so fish powder has the potential to be a technological alternative for the food industry to provide protein enriched pasta.

Conservation. RaLonde and Walczak (1970b) reported that 90% of the bream caught in Iran in 1970 were immature and the stock was in danger of extinction.

During the 1980s and 1990s there were practically no catch figures for this species in Iran. Artificial propagation began in 1986 on an experimental basis and 6 million fish were released (Ghenaat Parast, 1993). A state supported stocking programme released about 70-80 million fingerlings into the Anzali Talab, all descended from a single pair mating eight years ago (Bartley and Rana, 1998a, 1998b). These fish are intolerant of low oxygen and so perform poorly under pond conditions. Stocks may be imported from Azerbaijan in the future (Rana and Bartley, 1998). The release of 70.46 million fry in the 1992-1993 to 1998-1999 period was not successful in restoring the stocks in Iran. Stock depletion was attributed to improper fishing methods, pollution, destruction of spawning grounds, presence of predatory *Esox lucius* (northern pike) and *Silurus glanis* (European catfish) in fry stocking areas, and lack of necessary arrangements in regard to artificial spawning (Saiad Borani, 2001).

In 1992-1993 (an Iranian calendar year), 2.4 million fingerlings were released into the Anzali Talab and nearby rivers, a 100% increase over the previous year (*Abzeeyan*, Tehran, 4(2):VI, 1993). Total production in government hatcheries for 1990 was 0.66 million fingerlings, in 1991 2.28 million and in 1992 5.3 million fingerlings (Emadi, 1993a). Fingerling production was 11.217 million in 1995 and 8.5 million in 1996 (Bartley and Rana, 1998a, 1998b). In 1999-2000, 20 million juveniles were released (*Iranian Fisheries Research Organization Newsletter,*

23:4, 2000). From October to March 2000, 14 million juveniles raised in the Shahid Ansari aquaculture and breeding centre in Gilan were released into the Caspian Sea and neighbouring water bodies (*Iranian Fisheries Research Organization Newsletter*, 26:2, 2001). Illegal fishing and non-standard nets threaten the stocks (*Annual Report, 1995-1996, Iranian Fisheries Research and Training Organization, Tehran*, pp. 19-20, 1997). Billard and Cosson (2002) gave an annual production of 15 million alevins. Omidvar *et al*. (2017) cited 20 million annual production of young by government hatcheries.

Asgari *et al*. (2013) noted that 19 million fry (about 0.5 g) are released annually from the Shahid Ansari Hatchery Centre, Gilan, mostly to the Anzali Wetland (4‰ salinity), but also to the Sefid River (0.5‰), the Sefid estuary (8‰) and the Caspian Sea proper (12‰). They experimented on mortality at these salinities and found it to be significantly lower at 4‰, confirming the Anzali site to be best for release.

Mono- and polyculture of this species has been carried out in Iran (*Annual Bulletin 1993-94, Iranian Fisheries Research and Training Organization, Tehran*, pp. 77-78, 1995). Polyculture comprised 70% *Abramis brama*, 20% silver carp (*Hypophthalmichthys molitrix*) and 10% grass carp (*Ctenopharyngodon idella*) and gave a greater yield than monoculture. From an average initial weight of 30 g, fish attained averages of 188 or 211 g in monoculture (average 200 g) and 221 or 278 g (average 250 g) in polyculture with maximum weights of 300 or 580 g at the end of two one-year periods. Water temperatures were 9-33°C (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran,* pp. 38-39, 1996; Danesh-e-Khoshashi, 1997).

Ramin (1997a) detailed studies on the artificial breeding of this species in Iran, based on 38 brooders, with the goal of saving it from extinction. Gonadotropic hormone extracted from the pituitary of the common carp was used to induce brooders. One or two doses at 5-6 mg/kg body weight gave optimum stripping of eggs at 18°C. Fertilisation rate was 75-95% and hatching rate was 75-85%. Incubation took nearly four days at 18-21°C. The grey, pink or yellow eggs numbered 9,142-60,050 per spawner with a swelled diameter of 1.0-1.2 mm. The yolk sac was absorbed after 72 hours and newly hatched larvae were 2.9-3.7 mm long. Koohilai *et al*. (2010a, 2010b) studied optimum doses of various hormones used to stimulate ovulation. Khara *et al*. (2009) (see above) carried out their molecular study in order to determine sources for broodstock to increase genetic diversity after losses from overfishing, pollution and loss of spawning regions.

Kiabi *et al*. (1999) considered this species to be vulnerable in the south Caspian Sea basin according to IUCN criteria. Criteria included commercial fishing, sport fishing, few in number, habitat destruction, limited range (less than 25% of water bodies), not present in other water bodies in Iran, and present outside the Caspian Sea basin. Nezami *et al*. (2000) considered this species to be endangered in Iran because of overfishing, habitat destruction and spawning ground degradation. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

The subspecies has been proposed for inclusion in the *Red Book of the U.S.S.R.* which forms the basis for measures to protect species (Pavlov *et al*., 1985). About 19-20% of commercial catches in the Volga region are from hatchery raised stock (Petr, 1987) and it was thought that stocking could help this species.

Sources. The chief literature summary for earlier works is Backiel and Zawisza (1968) although little apparently refers to the Caspian basin populations and even less to those of the Iranian shore. Nevertheless, this work gave a general overview of biology and general comments above are based on it.

Iranian material:- CMNFI 1970-0542, 4, 75.4-173.7 mm standard length, Gilan, Old Sefid River estuary (37°23'N, 50°11'E); CMNFI 1970-0543A, 1, 70.0 mm standard length, Gilan, Caspian Sea at Hasan Kiadeh (37°24'N, 49°58'E); CMNFI 1970-0553, 3, not kept, Gilan, Sowsar Roga River (37º27'N, 49º30'E); CMNFI 1970-0587, 143, not kept, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1971-0343, 1, 158.6 mm standard length, Gilan, Langarud at Chamkhaleh (37°13'N, 50°16'E); CMNFI 1979-0689, 1, not kept, Gilan, Sefid River at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1980-0127, 3, 166.1-170.1 mm standard length, Gilan, Caspian Sea near Hasan Kiadeh (37°24'N, 49°58'E); CMNFI 1980-0136, 1, not kept, Mazandaran, Fereydun Kenar River estuary (36º41'N, 52º29'E); CMNFI 1980-0139, 1, not kept, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0140, 12, not kept, Gilan, Astara Talab close to sea (ca. 38º26'N, ca. 48º53'E); CMNFI 1980-0142, 1, 160.6 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1980-0906, 3, 105.6-176.0 mm standard length, Iran, Caspian Sea basin (no other locality data).

Genus *Acanthobrama*

Heckel, 1843

This genus comprises 13 species endemic to Southwest Asia with four found in Iran (Goren *et al*., 1973; Krupp, 1985c; Perea *et al*., 2010).

Howes (1981) placed *Acanthobrama* Heckel, 1843 in the genus *Rutilus* Rafinesque, 1820 on osteological grounds but most other authors have retained *Acanthobrama* as a distinct genus (Coad, 1984; Krupp, 1985c; Eschmeyer, 1990; Bănărescu, 1992b) based on the scale, keel and anal fin characters listed below. Berg (1948-1949) characterised the genus *Acanthalburnus* Berg, 1916 with two species (*microlepis* and *urmianus*) as similar to *Alburnoides* but with the last dorsal fin unbranched ray thickened into a spine which is strong basally but becomes thinner and flexible on about the last third of the ray length. Durand *et al*. (2002a, 2002b) included *Acanthalburnus* in the *Abramis* clade based on cytochrome *b* data while Perea *et al*. (2010) using mitochondrial and nuclear DNA proposed synonymy of *Acanthalburnus* with *Acanthobrama* as followed here.

The genus *Trachibrama* Heckel, 1843 is a *lapsus* (Krupp and Schneider, 1989).

Acanthobrama is characterised by a compressed, deep body of small to moderate size, no barbels, mouth terminal or inferior, relatively small scales with reduced numbers of radii, a fleshy keel of varying extent (full to one scale length) between the base of the pelvic fins and the vent, the last dorsal fin unbranched ray is thickened, spine-like or strong and smooth, and the anal fin is long (9-22 branched rays). Pharyngeal teeth are usually in a single row on each arch, but two rows in species formerly in *Acanthalburnus*. The gut is short. *A. persidis* is included in this genus based on mitochondrial and nuclear DNA characters but differs in some morphology (see species description).

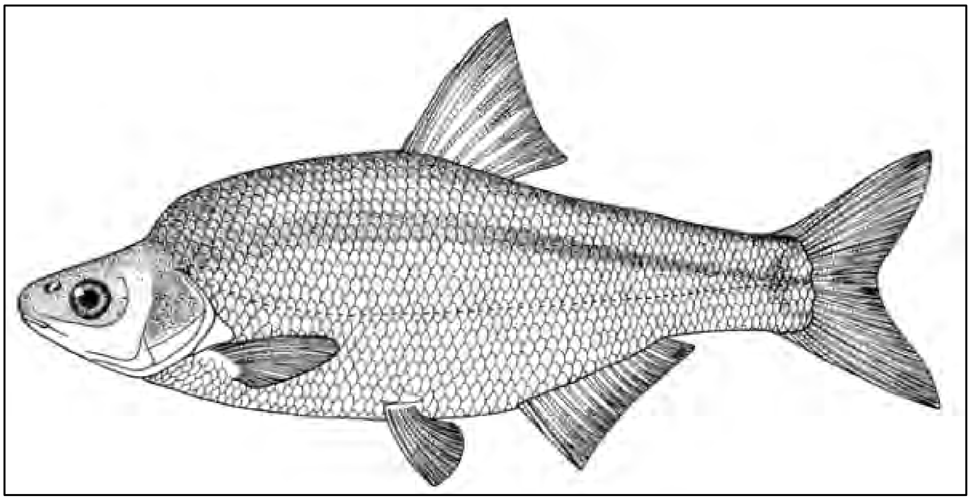
Abbasi Ranjbar *et al*. (2018) compared three Iranian species using six meristic and 16 morphometric characters. Species differed in all but pectoral fin length in morphometric characters and significant meristic differences were found in lateral line scales, dorsal fin unbranched and branched rays, and anal fin branched rays. *A. microlepis* and *A. urmianus* formed a clade separate from *A. marmid*.

The following table summarises some key distinguishing characters of the Iranian species of *Acanthobrama*.

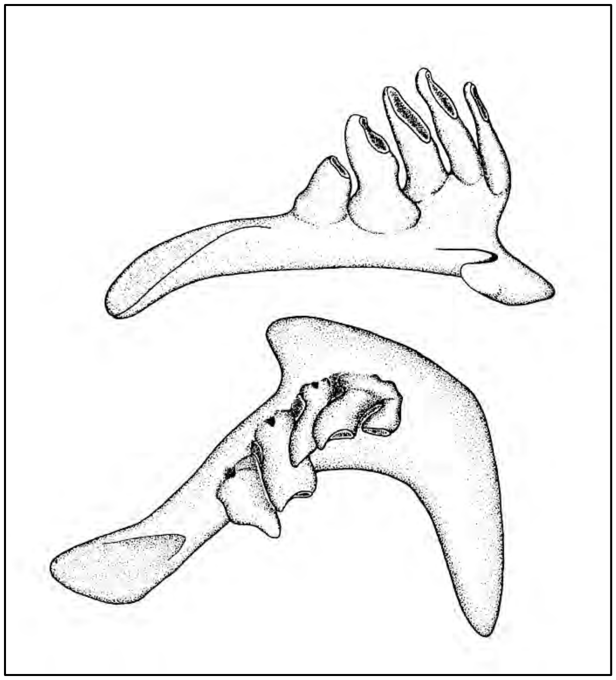
Species/ Characters	Modal dorsal fin	Lateral line	Anal fin branched	Naked ventral	Pharyngeal teeth	Distribution

	branched rays	scales	rays	keel		
Ac. marmid	8	53-77	13-22	Present	5-5	Tigris River
Ac. microlepis	8	60-87	12-19	Present	2,5-5,2	Caspian Sea
Ac. persidis	7	35-43	7-9	Absent	1,5-4,1	Hormuz, Kor River, Lake Maharlu, Persis
Ac. urmianus	8	50-68	10-13	Present	2,5-5,2 or 2,5-4,2	Lake Urmia

Acanthobrama marmid
Heckel, 1843



Acanthobrama marmid
S. Laurie-Bourque @ Canadian Museum of Nature.



Acanthobrama marmid, pharyngeal teeth,
Freidhelm Krupp.

Acanthobrama marmid, Iran, Gamasiab River, July 2008, Keyvan Abbasi.

Common names. Kalashpa, mahi sim nama (= bream-like fish), shebeh nazy, shebhe nazi (= resembling nazi, nazi meaning cute, Y. Keivany, pers. comm., 25 September 2018), shebeh sardin (= pseudo-sardine or resembling sardine).

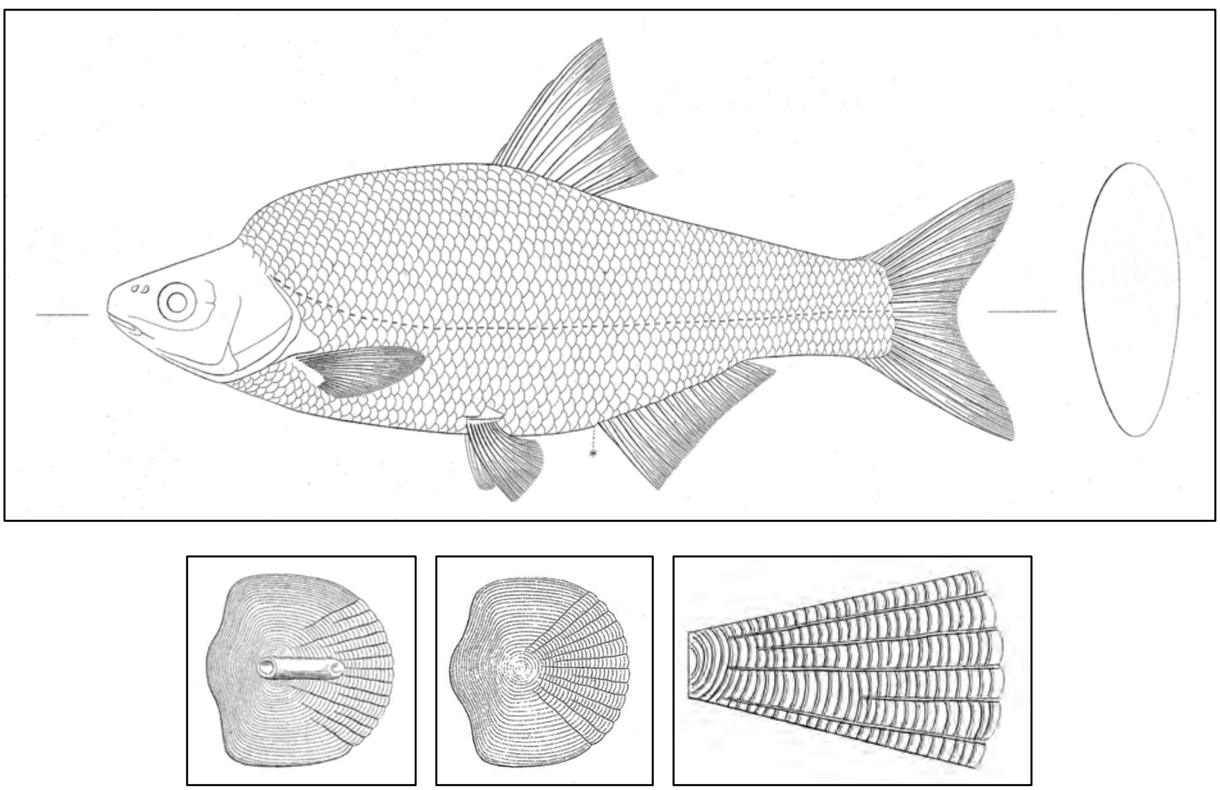
[Semnan arrez; samnan areed (samnan meaning sleek, healthy, fat, corpulent, and aridh meaning wide, broad, referring to the deep body, often humped behind the head, hence long, sleek fish (Mikaili and Shayegh, 2011)); arath (Rahemo, 2011); marmid, marmid handscherli (meaning marmid, armed with a dagger), marmid abbiad (meaning white marmid), marmid asphar (meaning yellow marmid) or marmid mablue (meaning swallowing or devouring marmid) at Aleppo, arrhada (meaning dove, lion!) at Mosul (all these latter Arabic names after Heckel (1843b, 1847a), the conflicting names for arrhada included, and are probably antiquated); Akçapak or Akçapak balığı (Turkish) and Kızılkanat (local name in eastern Turkey) (Kaya *et al*.,

2016; Çiçek *et al*., 2020); Tigris bream, Mesopotamian bream].

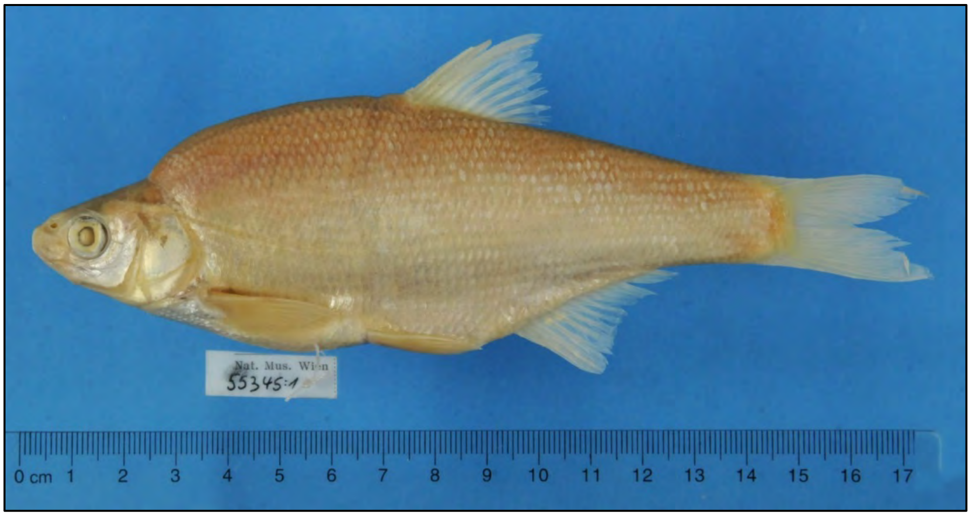
Systematics. *Acanthobrama Arrhada* Heckel, 1843, *Acanthobrama cupida* Heckel, 1843 and *Acanthobrama marmid* morpha *elata* Berg, 1949 are synonyms. *Acanthobrama marmid orontis* Berg, 1949 is now regarded as a distinct species.

The type locality for *Acanthobrama Marmid* is “Gewässern bei Aleppo”, for *Acanthobrama arrhada* “in Mossul”, and for *Acanthobrama cupida* “in Aleppo” according to Heckel (1843b) and “Flusse Kueik bei Aleppo” in Heckel (1847a). The type locality of *Acanthobrama marmid* morpha *elata* is Lake Balikli, 12 km from Erzurum, 8 km from the Karasu River, upper Euphrates, in Turkey. The type locality of *Acanthobrama marmid orontis* was given as the upper Euphrates region according to Eschmeyer *et al*. (1996) (but this is an error, see below, corrected in later, online versions of the *Catalog of Fishes*).

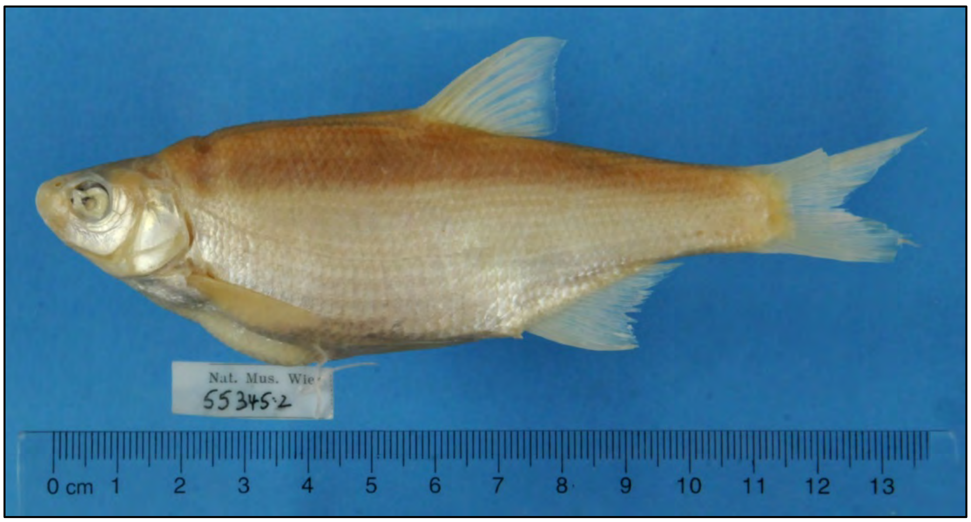
The *Catalog of Fishes* (downloaded 15 August 2020) gives the syntypes of *A. marmid* as NMW 55345-48 (2, 2, 2, 2), NMW 79068 (2), RMNH (Rijksmuseum van Natuurlijke Historie, Leiden) 2537 (4) and RMNH 2539 (2) (formerly NMW), and SMF (Senckenberg Museum Frankfurt) 543 (4) (formerly NMW). Details on the syntypes of this species and its synonyms *A. arrhada* and *A. cupida* in the Naturhistorisches Museum Wien and the Senckenberg Museum Frankfurt were given by Krupp (1985c). Lengths were NMW 55345, 2, 113-139 mm standard length, NMW 55346, 2, 86-121 mm standard length, NMW 55347, 2, 98-126 mm standard length, NMW 55348, 2, 113-132 mm standard length, NMW 79068, 2, 114-138 mm standard length, and SMF 543, 4, 82-112 mm standard length.



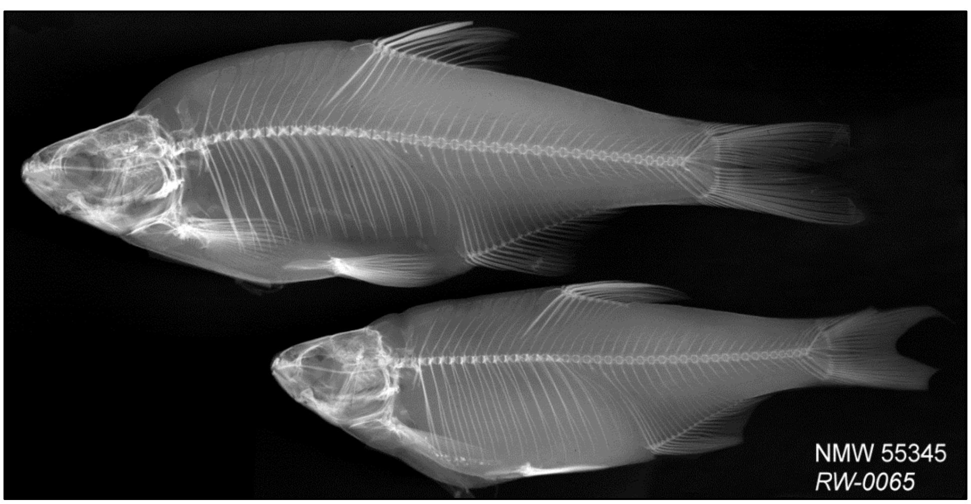
Acanthobrama marmid,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.



Acanthobrama marmid, syntype, NMW 55345, Naturhistorisches Museum, Wien.

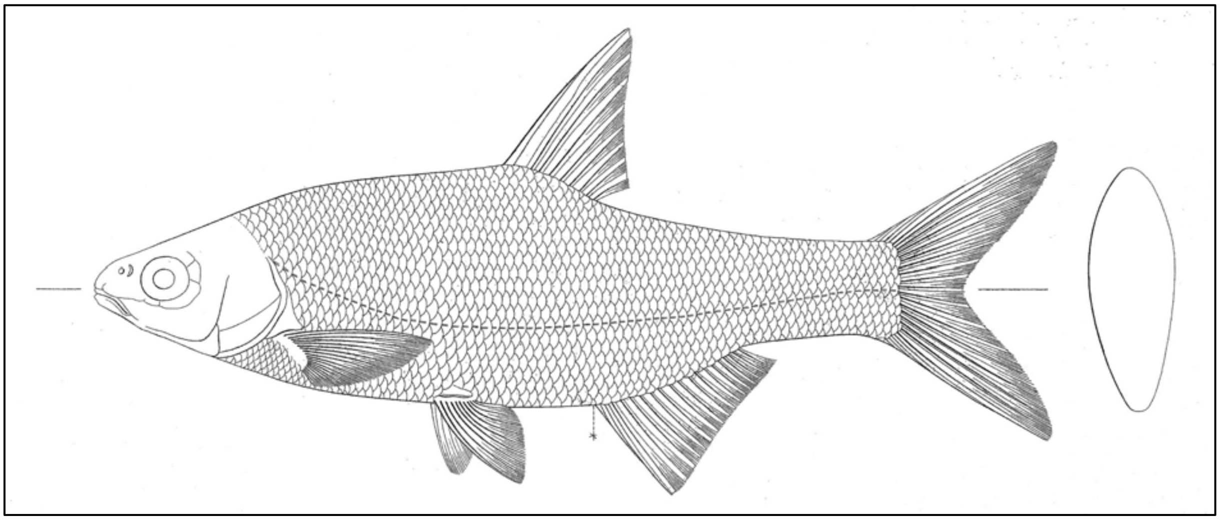


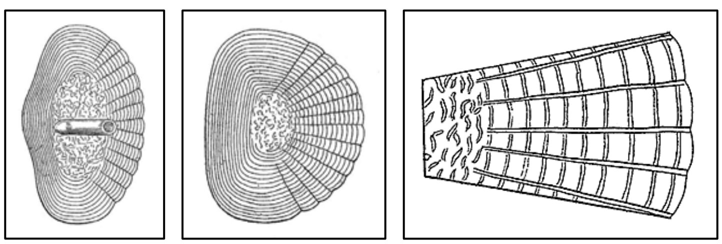
Acanthobrama marmid, syntype, NMW 55345, Naturhistorisches Museum, Wien.



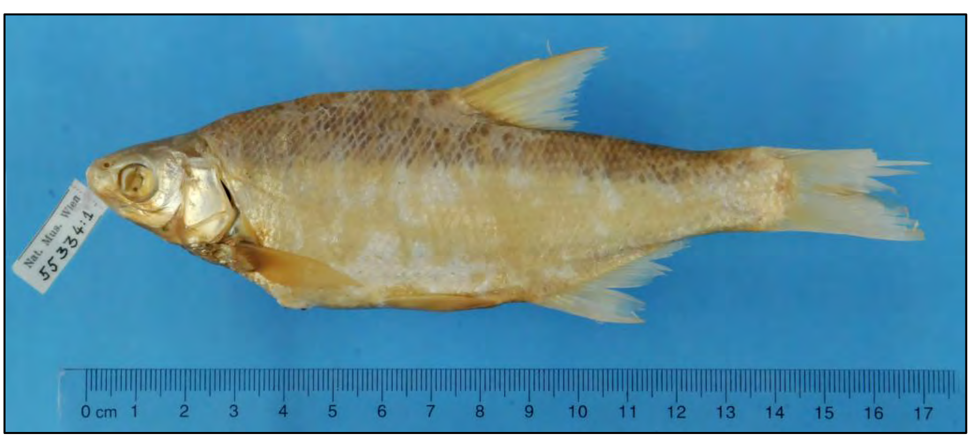
Acanthobrama marmid, syntypes, NMW 55345, Naturhistorisches Museum, Wien.

Two syntypes of *A. arrhada* from Mosul, 85-92 mm standard length, are in the Senckenberg Museum Frankfurt (SMF 411, formerly NMW) (F. Krupp, pers. comm., 1985; 85.7-89.0 mm standard length) while two others are in the Naturhistorisches Museum Wien, ca. 150 mm standard length (NMW 55335) and 141 mm standard length (NMW 55336) (Krupp, 1985c). However, the Vienna catalogue listed six specimens of *A. arrhada* and in addition to the above material there was also NMW 55334 (8 fish) tagged as syntypes. Two syntypes are in the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH 2538) (Eschmeyer *et al*., 1996). Further details are in the Ichthyology Type Database, NMW.

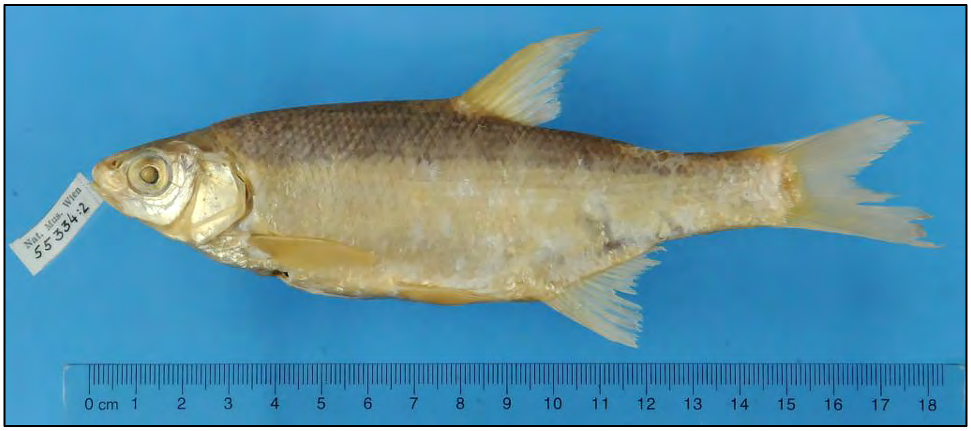




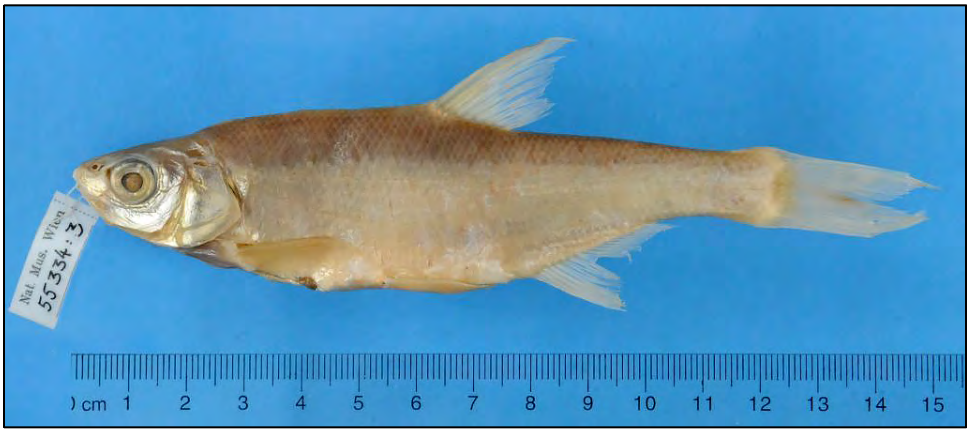
Acanthobrama arrhada,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line (regenerated), and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.



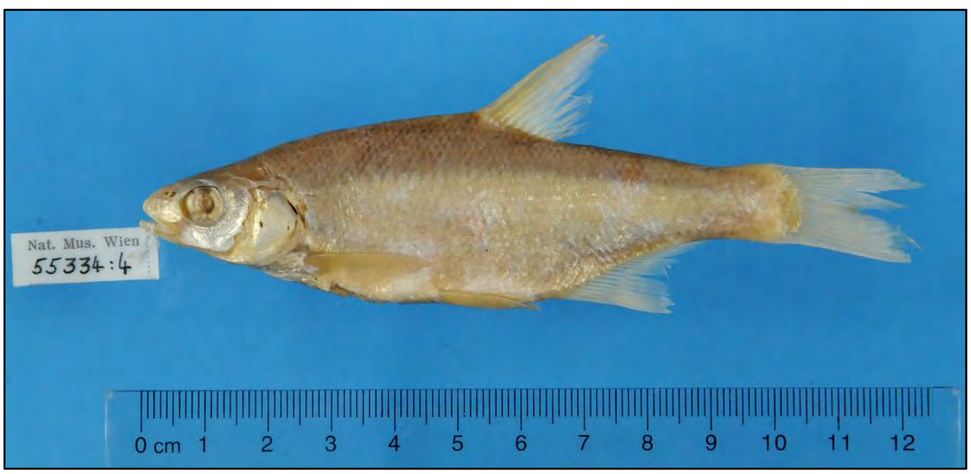
Acanthobrama arrhada, NMW 55334, syntype, Naturhistorisches Museum, Wien.



Acanthobrama arrhada, NMW 55334, syntype, Naturhistorisches Museum, Wien.

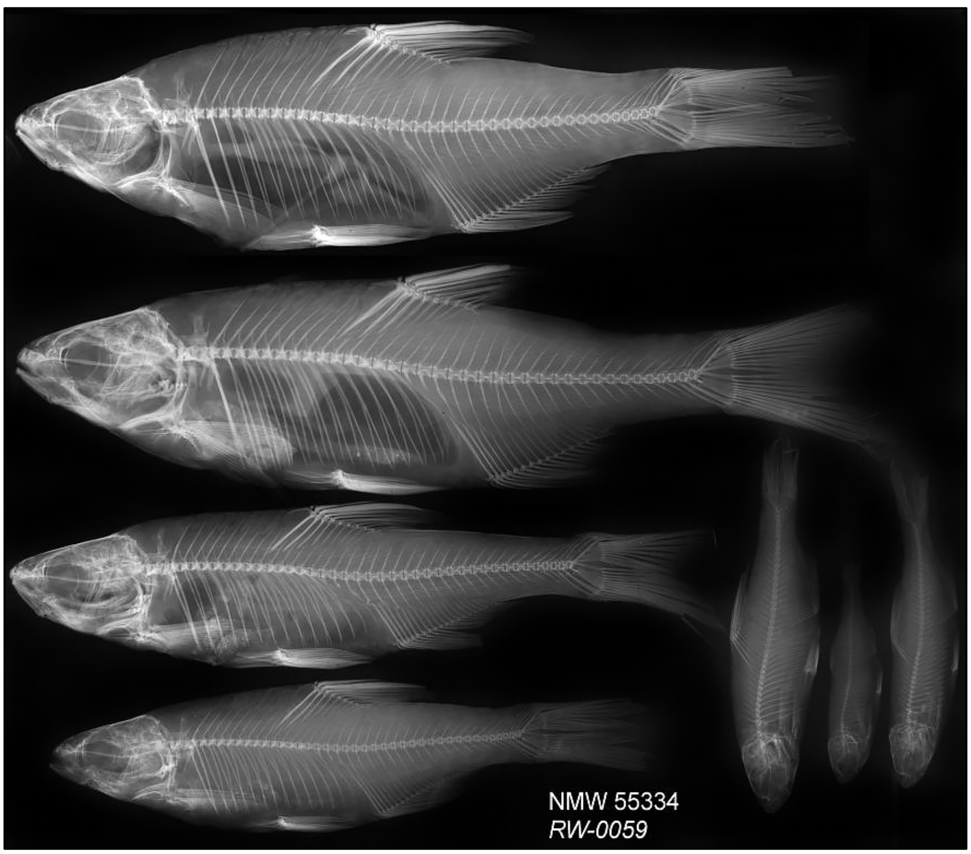


Acanthobrama arrhada, NMW 55334, syntype, Naturhistorisches Museum, Wien.



Acanthobrama arrhada, NMW 55334, syntype, Naturhistorisches Museum, Wien.

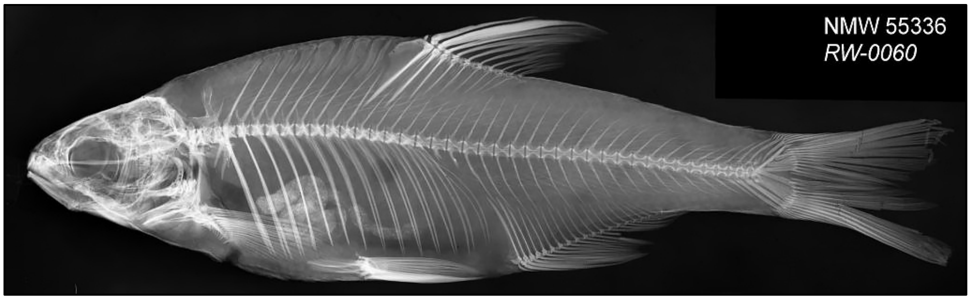
Acanthobrama arrhada, NMW 55334, syntypes, Naturhistorisches Museum, Wien.



Acanthobrama arrhada, NMW 55334, syntypes, Naturhistorisches Museum, Wien.

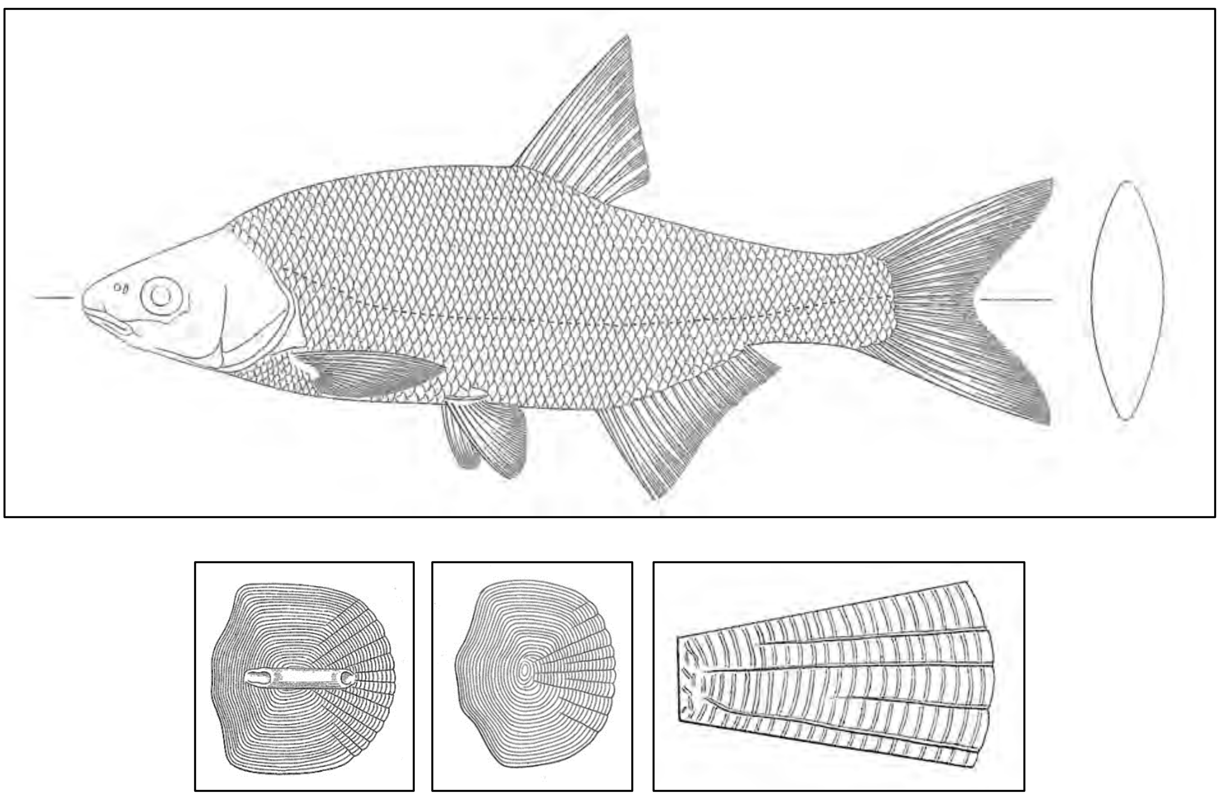
Acanthobrama arrhada, syntype, NMW 55335, Naturhistorisches Museum Wien.

Acanthobrama arrhada, NMW 55336, syntype, Naturhistorisches Museum, Wien.

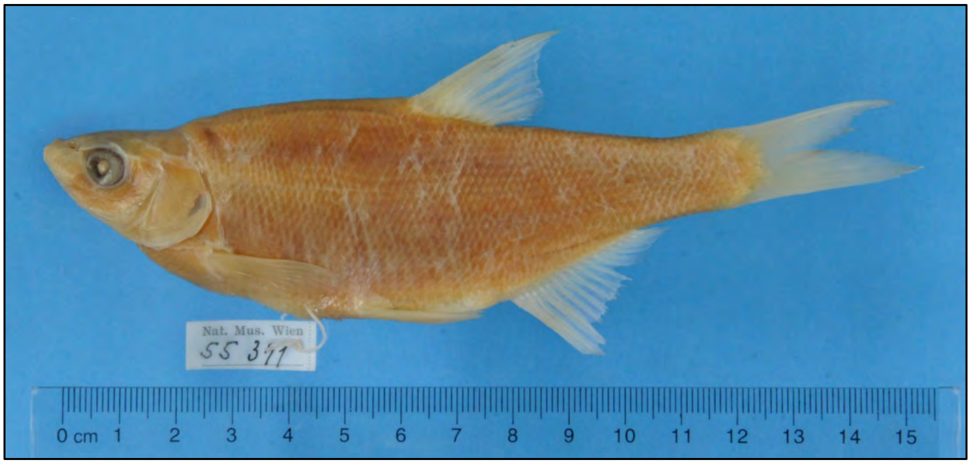


Acanthobrama arrhada, NMW 55336, syntype, Naturhistorisches Museum, Wien.

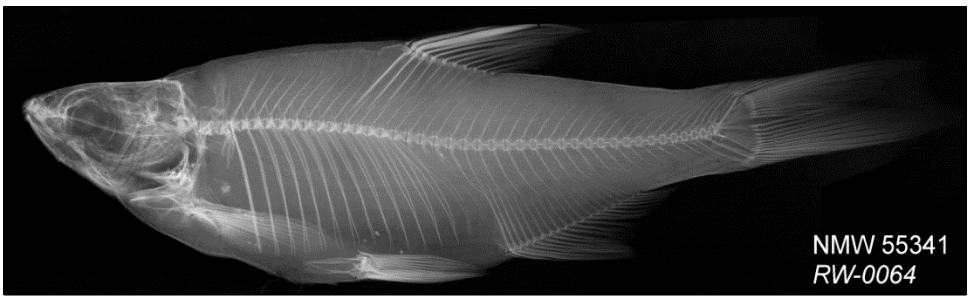
Krupp (1985c) recorded syntypes of *A. cupida*, 151 mm standard length (NMW 55340) and 152 mm standard length (NMW 55341) (the Ichthyology Type Database, NMW (downloaded 9 July 2016) gave 125 mm and 121 mm standard length for these two fish). The Vienna catalogue listed four *A. cupida* which agrees with Heckel's description although I observed only NMW 55340 (1 fish), NMW 55341 (1) and also NMW 55342 (1) (101 mm standard length in the Ichthyology Type Database, NMW (downloaded 9 July 2016)). Eschmeyer *et al*. (1996) listed NMW 55340-43 (1, 1, 1) as syntypes but the numbers indicated four fish. The card index in Vienna in 1997 also listed 55505 (5), one of which was designated as the lectotype.



Acanthobrama cupida,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.



Acanthobrama cupida, syntype, NMW 55341, Naturhistorisches Museum, Wien.



Acanthobrama cupida, syntype, NMW 55341, Naturhistorisches Museum, Wien.

The two syntypes of *Acanthobrama marmid orontis* are in the Zoological Institute, St. Petersburg under ZISP 6720 from "L. Antioch, 1884, Lortet" according to Berg (1949). This subspecies is distinguished only by larger scales from the typical form but the two syntypes examined by me had lost their scales and were difficult to count; one seemed to have a count around 64, not as low as 54-55 recorded by Berg (1949). Krupp (1985c) examined type material and new specimens from the Orontes and found them not to differ from *A. marmid* from the Quwayq and Tigris-Euphrates basins. He accordingly synonymised *Acanthobrama marmid orontis* with the type subspecies but this taxon is now recognised as a distinct species (*Catalog of Fishes*, downloaded 9 July 2016).

Karaman (1972) considered *Acanthobrama arrhada* to be a subspecies of *A. marmid* rather than a synonym based on an unusually strongly ossified spiny dorsal fin ray in the former. Since *A. marmid* was described from Aleppo (= Halab, Syria) and *A. arrhada* from Mosul, the synonomy of these two taxa may warrant re-examination.

The fish reported from the Tigris River basin of Iran by Nümann (1966) as *Xenocypris macrolepidotus* was this species (Zoologisches Institut und Zoologisches Museum, Hamburg catalogue number ZMH H2700 examined by me). Saadati (1977) thought it a new species of *Acanthobrama* but I disagree.

A hybrid with *Chalcalburnus mossulensis* (= *Alburnus sellal*) was reported from the Hawr al Hammar in southern Iraq by Krupp *et al*. (1992).

Key characters. This species is distinguished from other members of the genus by having 53 or more lateral line scales, dorsal fin branched rays modally 8, anal fin branched rays 13 or more, and pharyngeal teeth in one row (5-5).

Morphology. Different body forms occur in slow-flowing and fast-flowing waters. In the

former habitat fish have a deep body, often humped behind the head, while in the latter the body is more streamlined (Karaman, 1972). It seems that *A. marmid* was founded on the humped form and *A. arrhada* and *A. cupida* on the streamlined one although the two types pictured above show both forms. The body is deepest at the dorsal fin origin. The predorsal profile is convex. The dorsal head profile is straight. The caudal peduncle is compressed and relatively deep. The eye lies almost at, or at, the beginning of the anterior half of the head. There is a groove over the head before the nostrils. The mouth is nearly horizontal to oblique, equal or lower jaw slightly behind the upper. Lips are of medium thickness. The last dorsal fin unbranched ray is a thickened, stiff and smooth spine, the rigid part varying from 15 to 26% of standard length. The spine may be strong for much of its length and then abruptly become thin and flexible or it may taper gradually to a flexible tip. Some small fish lack an enlarged dorsal fin spine. The dorsal fin margin is slightly concave. The depressed dorsal fin reaches back level with the mid-anal fin. The caudal fin is moderately forked with pointed to rounded tips, the lower tip being more rounded. The anal fin margin is straight to concave and the fin does not extend back to the caudal fin base, falling well short. The pelvic fin is rounded and extends back to the anal fin or falls short. The pectoral fin is rounded and extends back to the pelvic fin or falls just short.

Dorsal fin unbranched rays 3 and branched rays 7-9, usually 8, anal fin unbranched rays 3 and branched rays 13-22, pectoral fin branched rays 12-18, and pelvic fin branched rays 7-9. Lateral line scales 53-77, scales above the lateral 10-14, and scales between the pelvic fin and lateral line 4-7. There is a pelvic axillary scale. The belly has a fleshy keel where the ventral scales do not meet along the mid-line between the pelvic base and the anus. Scales are squarish to rounded in shape with a rounded posterior margin, gently rounded dorsal and ventral margins, and a posterior margin with a central rounded projection flanked by an indentation above and below or a rounded margin. Radii are restricted to the posterior field on scales and are moderate to few in number (5-7 according to Küçük *et al*. (2014) but up to at least 13 (see figures above)). The focus is subcentral anterior to almost central. Circuli are moderate in number. Total gill rakers number 12-17, and are short with a basal swelling, with 2-4 on the upper arch, 0-1 at the flexure and 9-12 on the lower arch. The rakers reach the one below or to its further base end when appressed. Pharyngeal teeth are usually 5-5, with the anterior tooth compressed and bluntly pointed, the remainder beveled with a cutting edge and a hooked tip. The two anterior teeth are more rounded than the others although the second one may have a slight hook and is beveled. Tigris River basin fish may have 1-2 teeth in a second row. The gut is an elongate s-shape with a large anterior loop in larger fish. Total vertebrae number 38-44 (38(3), 39(3), 40(7), 41(5), 42(7) or 43(1) combining Iranian and Iraqi material), Küçük *et al*. (2014) recording 44 vertebrae. The two syntypes of *A. marmid*, NMW 55345, have 42 and 43 total vertebrae, the syntype of *A. arrhada*, NMW 55336, has 41 total vertebrae, four of the syntypes of *A. arrhada*, NMW 55334, have 41(1) and 42(3) total vertebrae, and the syntype of *A. cupida*, NMW 55341, has 43 total vertebrae. The diploid chromosome number is 2n = 50, with the karyotype consisting of eight metacentric, 13 sub-metacentric and four pairs of sub-telocentric to acrocentric chromosomes. The karyotype is nearly identical to other Eurasian leuciscine cyprinids (Gaffaroğlu *et al*., 2006).

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(1) or 8(8), anal fin branched rays 13(2), 14(2), 15(4), 16(-) or 17(1), pectoral fin branched rays 13(2), 14(3), 15(3) …. or 18(1), pelvic fin branched rays 7(1), 8(7) or 9(1), lateral line scales 54(1), 55(2), 56(2), 57(-), 58(1), 59(1) …. or 63(1), total gill rakers 12(1), 13(-), 14(6) …. or 17(1), pharyngeal teeth 5-4(1) or 5-5(7), and total vertebrae 38(3), 39(1), 40(-), 41(2), 42(2) or 43(2).

Sexual dimorphism. Fine tubercles are found over the top, sides and bottom of the head

in males, particularly the operculum and snout with fewer on top of the head (CMNFI 1979-0287, 89.9-92.1 mm standard length, 7 July 1977 and CMNFI 1993-0128, 113.6 mm standard length, 11 May 1993). Tubercles line the first, pectoral fin unbranched ray irregularly with up to two branching rows. Very fine tubercles are found on the adjacent membrane and on the lower pectoral fin surface. Tubercles line the pelvic fin rays in branching rows. There are numerous very small tubercles on the anal fin rays. The lower caudal fin rays are lined with tubercles. Tubercles follow the branching of fin rays. Anterior upper flank scales, all belly scales, lower caudal peduncle scales and scales over the anal fin have their margin lined with small tubercles, the peduncle with some tubercles on the mid-scale and the belly with a concentration on the scale base.

Colour. The overall colour is silvery to whitish with the head and back reddish-brown. The flanks can be greyish to blackish from numerous melanophores. There may be a well-developed mid-flank stripe or it may be poorly developed or evident only posteriorly. The pelvic fins are bright red, the pectoral and anal fins less red and the dorsal and caudal fins reddish proximally and black distally. Fin colours may be more orange or yellow than red. All fin rays and membranes have melanophores and these can be quite concentrated such that some fish have dark fins. Young fish in preservative have numerous, distinctive, small to minute, rounded, square or oblong patches of pigment in 1-3, irregular, mid-flank rows. The peritoneum is black, silvery with a dorsal concentration of melanophores, or with widely scattered melanophores so it appears silvery.

Size. Reaches 20.8 cm (Berg, 1949).

Distribution. This species is found in the Tigris-Euphrates basin of Turkey, Syria, Iraq and Iran. In Iran, it is found in the Tigris River basin including the Ab-e Shur, Abloun, Arvand, Bahmanshir, Dinvar, Gamasiab, Karkheh (and its upper reaches), Karun, Mareg, Marun, Nahr-e Shavor, Qareh Su, Shahvor, Shur, Talkhab and Zard rivers, and in marshes such as the Hawr al Azim and the Khondab and Pir Salman wetlands (Abbasi *et al*., 2009; Abbasi Ranjbar *et al*., 2018; Khamees *et al*., 2019; Eagderi *et al*., 2020; Jouladeh-Roudbar *et al*., 2020).

Zoogeography. The majority of species are found in the Levant which once had connections to the Tigris-Euphrates basin (Krupp, 1985c).

Habitat. This species is found in rivers, streams, canals, dams, marshes and springs. Hussain *et al*. (1997) reported this species to be dominant in the small fish assemblages in the Shatt al Arab near Basrah, Iraq at 70.8% of 14,084 fish caught. It favours side branches off the Shatt al Arab, presumably to avoid predators which are found in deeper water. Younis *et al*. (2001b) noted that this species dominated in the polluted and disturbed environment of a dockyard on the Shatt al Arab. This was one of the most abundant species in the recovering marshes of southern Iraq in 2005-2006 (Hussain *et al*., 2006) and is also known from large rivers and dams.

Habitat of *Acanthobrama marmid* (and *Arabibarbus grypus, Capoeta trutta, Cyprinion macrostomus* and *Garra rufa*), CMNFI 1979-0384, Khuzestan, river in Ab-e Shur drainage, 30 January 1978, Brian W. Coad.

Age and growth. Eagderi *et al*. (2020) examined 9 fish, 4.85-15.49 cm total length, from the Dinvar River and found a *b* value of 3.29, positively allometric. Valikhani *et al*. (2020) combined fish from the Shadegan Wetland and the Dez and Karkheh rivers and reported a *b* value of 2.65 and a condition factor of 1.54 for 342 fish (2.7-8.7 cm total length), the only species of 16 with negative allometric growth. Mouludi-Saleh *et al*. (2021) examined 88 fish, 3.6-13.7 cm total length, from the Gamasiab River and recorded a *b* value of 3.13, positive allometric, and a condition factor of 1.25.

Al-Nasiri and Salman (1977) studied this species in the Little Zab River, Iraq. Their largest specimen was 13.7 cm. They described length-weight relationships and condition factors but some important length groups were missing from their samples. Condition factor showed a gradual decrease with increasing length and the means for actual and calculated weights were 1.141 and 1.118 respectively. Relative condition factor was 1.0009. Younis *et al*. (2001a) examined three populations of this species in the Shatt al Arab, Iraq and found the 0^+ age group to be represented by fish 2.1-11.0 cm long and 1^+ age group by fish 8.3-14.1cm. The length-weight relationship was $W = -3.821L^{2.32}$. Four age groups with a length range of 4-19 cm were found in the Qarmat Ali River of southern Iraq, with maturity in the first year (Saud, 1997).

Ünlü *et al*., (1994) examined a population of this species in the Tigris River, Turkey and gave figures for growth in length and in weight. Females grew faster and were larger in size than males at the same age, particularly for age groups 3 and 4. Condition factor for males was 1.554 and for females 1.55. They found five age groups with age group 3 dominant for both sexes. Overall female:male sex ratio was 1.83:1. Sexual maturity was attained by 75% of females and 85% of males in the second year of life and all fish in age group 3 were mature. Alkan Uçkun and Gökçe (2015a) found that 586 Karakaya Dam fish, 11.0-19.2 cm total length, from the upper Euphrates basin of Turkey attained 4^+ years, length-weight relationship was $W = 0.029FL^{2.678}$ for females and $W = 0.03FL^{2.631}$ for males, growth in length equations were $L_t = 17.3[1\text{-}e^{-1.37(t+1.04)}]$ for females and $L_t = 16.6[1\text{-}e\text{-}^{1.29(t+1.04)}]$ for males.

Food. Heckel (1843b) suggested that they are ravenous feeders based on the name "swallowing marmid". Gut contents are crustaceans, insects, and plant and gastropod shell fragments in Iranian specimens examined by me. Younis *et al*. (2001a, 2001b) found Shatt al Arab, Iraq fish to be detritivores, having organic detritus as the dominant gut content, followed by phytoplankton (blue-green algae and diatoms), small crustaceans (ostracods, cyclopoids, cladocerans), and aquatic plants, with dominance varying by month. In a study of the recovering Hammar Marsh, Iraq, diet was 70.77% insects and 9.81% algae with diatoms, plants, crustaceans and snails at less than 10% each, in the Hawr al Hawizeh 66.4% insects and 14.1% algae, with amounts of diatoms and various crustaceans being less than 10% each, and in the Al Kaba'ish (= Chabaish) Marsh 62.7% insects and 17.7% algae with diatoms, plants and various crustaceans at less than 10% each (Hussain *et al*., 2006).

Reproduction. Well-developed testes were noted in fish caught on 7 July 1977 (CMNFI 1979-0287) near Ravansar, Kermanshah.

Younis *et al*. (2001a) found most females to be ripe in March and July samples, and some were spent, in Iraqi fish. Ünlü *et al*., (1994) reported spawning in May to late June for their Tigris River, Turkey population. They cited data for a Keban Dam population (on the Euphrates River in Turkey) where the spawning season was extended and ran from April to August. Egg diameter exceeded 1.2 mm and egg numbers reached 8,125, and elsewhere may reach 11,000 eggs. In the Qarmat Ali River in southern Iraq, fecundity reached 1,759-9,293 eggs. Alkan Uçkun and Gökçe (2015a) found that Karakaya Dam, Turkey fish spawned from May to June.

Parasites and predators. None reported from Iran.

Economic importance. None in Iran. In the early 1990s in Iraq, this species was used for human consumption and for fish meal (Younis *et al*., 2001a).

Experimental studies. None.

Conservation. This species is rarely reported from Iranian waters and its status needs to be assessed through further field work. Endangered in Turkey (Fricke *et al*., 2007 Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

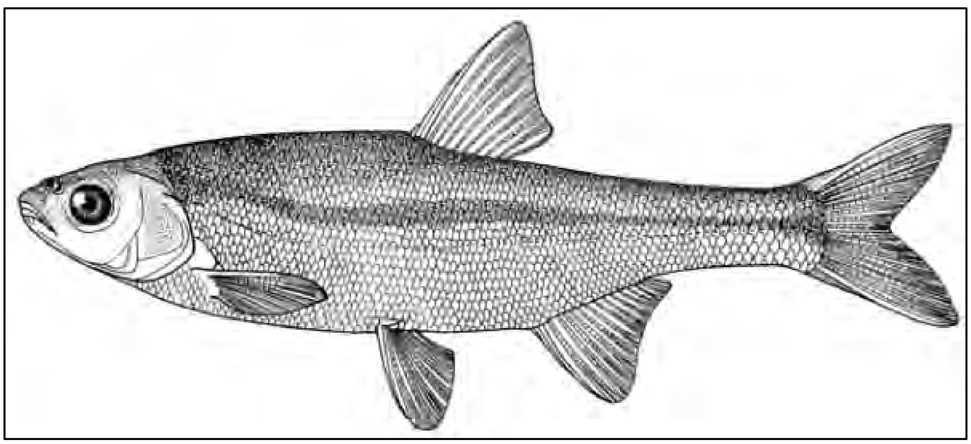
Sources. Type material:- See discussion above. *Acanthobrama marmid* (NMW 55345, NMW 55346, NMW 55347, NMW 55348, NMW 79068 and SMF 543), *Acanthobrama marmid orontis* (ZISP 6720), *A. arrhada* (NMW 55335, NMW 55336, NMW 55334 and SMF 411) and *A. cupida* (NMW 55340, NMW 55341, NMW 55342 and NMW 55505).

Iranian material:- CMNFI 1979-0287, 2, 89.9-92.1 mm standard length, Kermanshah, Cheshmeh Javari 2 km from Ravansar (ca. 34º42'N, ca. 46º40'E); CMNFI 1979-0360, 1, 40.6 mm standard length, Khuzestan, canal branch of Karkheh River (31º40'N, 48º35'E); CMNFI 1979-0377, 2, 28.5-34.6 mm standard length, Khuzestan, Karkheh River (ca. 32º57'N, ca. 47º50'E); CMNFI 1979-0384, 1, 23.1 mm standard length, Khuzestan, river in Ab-e Shur drainage (32º00'N, 49º07'E); CMNFI 1991-0154, 1, 113.6 mm standard length, Khuzestan, Hawr al Azim (ca. 31º45'N, ca. 47º55'E); CMNFI 1993-0128, 1, 113.6 mm standard length, Kermanshah, Sarab-e Sabz 'Ali Khan (34º25'N, 46º32'E); CMNFI 2007-0114, 1, 82.1 mm standard length, Kermanshah, Qareh Su basin (ca. 34º28'N, ca. 46º54'E); CMNFI 2008-0102, 1, 101.7 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data); CMNFI 2008-0163, not kept, Khuzestan, Marun River at Chahar Asiab (30º40'28"N, 50º09'34"E); CMNFI 2008-0236, 2, 90.3-90.8 mm standard length, Kermanshah, Mereg River (35º25'N, 46º17'E); ZMH H2700, 1, 145.0 mm standard length, Kermanshah, Gharasu-Gamasiab-Seymarreh (Qareh Su, Gamasiab and Simareh rivers, no other locality data).

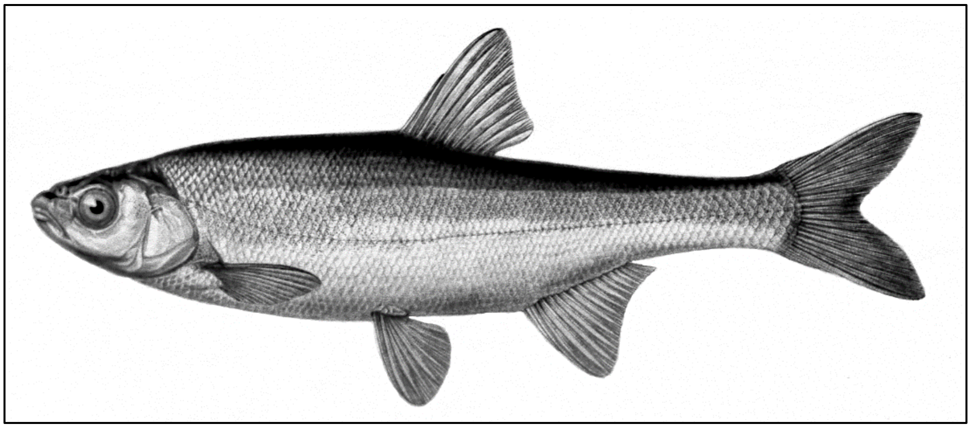
Comparative material:- BM(NH) 1920.3.3:147-156, 15, 29.5-102.0 mm standard length,

Syria, Ouadi Khneizer (no other locality data); BM(NH) 1931.12.21:22-25, 4, 65.7-84.6 mm standard length, Iraq, Mosul (ca. 36º20'N, ca. 43º08'E); BM(NH) 1968.12.13:108-112, 1 (of 5), 112.6 mm standard length, Syria, Ouadi Khneizer, Khabour (no other locality data) (collections amalgamated as BM(NH 1968,12.13:105-341 seem to include the preceding and following collections, 224 (7 as alizarin specimens), 24.1-69.7 mm standard length); BM(NH) 1968.12.13:113-118, 6, 56.5-117.4 mm standard length, Syria, River Euphrates at Houreira (no other locality data); BM(NH) 1971.4.2:7, 96.5 mm standard length, Iraq, River Tigris near Mosul (ca. 36º20'N, ca. 43º08'E); BM(NH) 1974.2.22:1078-1083, 6, 105.2-122.8 mm standard length, Iraq, Najab Bazar (no other locality data); BM(NH) 1974.2.22:1084-1091, 7, 105.1-118.3 mm standard length, Iraq, Najab Bazar (no other locality data); BM(NH) 1974.2.22:1092, 109.5 mm standard length, Iraq, Najab Bazar (no other locality data); BM(NH) 1974.2.22:1094, 109.3 mm standard length, Iraq, Great Zab River at Aski Kalak (36º16'N, 43º39'E); CMNFI 1987-0017, 3, 83.8-108.3 mm standard length, Iraq, Hawr al Hammar (no other locality data); CMNFI 1980-0810, 2, 114.8-118.3 mm standard length, Turkey, Göksu in Tigris River basin (no other locality data); CMNFI 1980-1036, 1, 101.5 mm standard length, Turkey, Keban Dam on Murat Nehri near Elâzığ (no other locality data); ZSM 26136, 5, 55.3-80.3 mm standard length, Syria, Assad Reservoir, Euphrates basin (no other locality data).

Acanthobrama microlepis
(De Filippi, 1863)



Acanthobrama microlepis
S. Laurie-Bourque @ Canadian Museum of Nature.



Acanthobrama microlepis, ZISP 5187, Turkey, Lake Chaldyr (= Çıldır) in the Aras River basin, after Berg (1916).

Acanthobrama microlepis, Gilan, Sefid River, August 2010, Keyvan Abbasi.

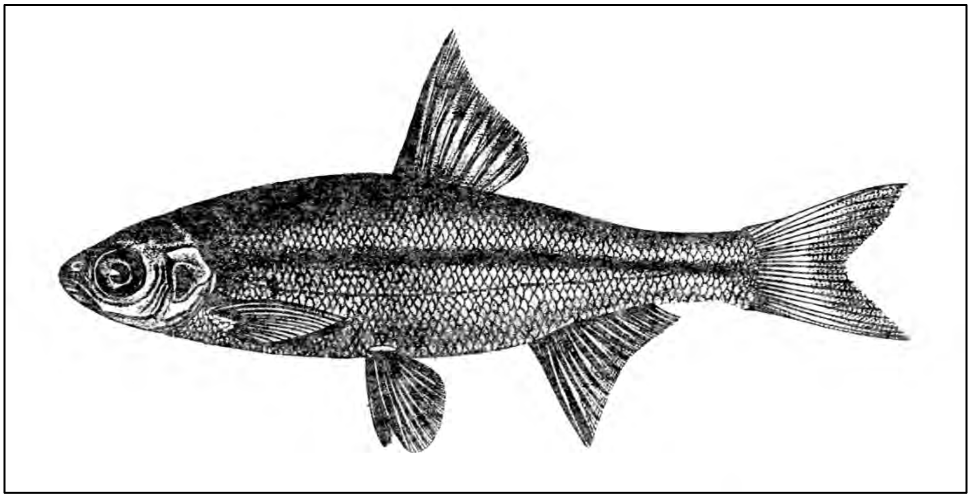
Acanthobrama microlepis, Turkey, Kura River at Yalnızçam, after Kaya *et al*. (2020).

Common names. Kuli (= general term for a small fish), morvarid mahi-e labnazok (= slender lip pearl fish).

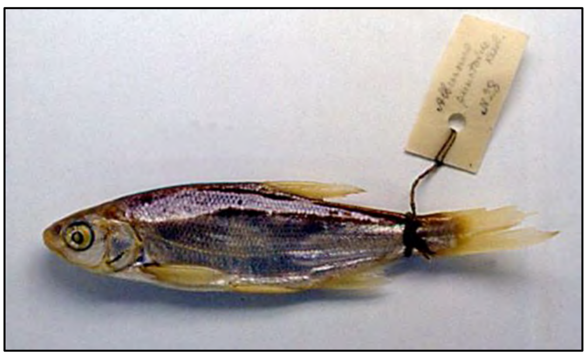
[Garagas or taxta balig, both in Azerbaijan; İnci baliği and Kura akçapağı in Turkish (Çiçek *et al*., 2020; Kaya *et al*., 2020); chernobrovka and napota in Russian; blackbrow bleak, Caucasian, oriental or carp bream].

Systematics. *Abramis microlepis* was described from the "Kur, presso Tiflis" (= Kura River near Tbilisi, Georgia) and the holotype is in the Istituto e Museo di Zoologia della R. Università di Torino under MZUT N.673 (Tortonese, 1940; Eschmeyer *et al*., 1996).

Alburnus punctulatus Kessler, 1877, described from the Kura River at Tiflis (= Tbilisi) and Borzhomi (= Borjomi), Georgia, is a synonym. A syntype of *Alburnus punctulatus* from the St. Petersburg Museum, 84.6 mm standard length, from “R. Kura, Tiflis” is in the Natural History Museum, London (BM(NH) 1897.7.5:34) and other syntypes are in ZISP 2915(5), 2924(6+) (*Catalog of Fishes*, downloaded 16 March 2018).



Alburnus punctulatus, syntype, after Kessler (1877).



Alburnus punctulatus, 84.6 mm standard length, BM(NH) 1897.7.5:34, Brian W. Coad.

“*Alburnus Brandtii*” is apparently a manuscript name for this species first reported without a formal description in Brandt (1880) and listed as “*Alburnus Brandtii* n. sp. 1 ex. Tschaldyr” (= Lake Çıldır in Turkey) and attributed to K. Kessler in the account of the travels of Professor A. F. Brandt in Transcaucasia (see Kavraiskii, 1897). Bogutskaya (1997) listed it as a *nomen nudum*.

Alburnus microlepis of Kamensky (1901), which is *Acanthalburnus microlepis*, should not be confused with *Alburnus microlepis* Heckel, 1843, a distinct species described from Aleppo (= Haleb, Syria) but a synonym of *A. sellal*.

Key characters. This species is distinguished from the related *A. urmianus* by having more lateral line scales, more anal fin branched rays, fewer gill rakers and gill raker morphology according to Saadati (1977). Gill raker counts are the same but scale and anal fin ray counts are generally higher with some overlap. Gill raker morphology does not appear to differ in the fish examined by me. Distribution is the easiest separating factor. Both species are distinguished from other cyprinids in Iran by the dorsal fin spine, two rows of pharyngeal teeth, and fin ray and

scale counts.

Morphology. The body is compressed and relatively deep, deepest at the dorsal fin origin. The predorsal profile is convex. A nuchal hump is present in larger fish. The caudal peduncle is relatively shallow and is compressed. The head is straight to a rounded snout. The rear of the eye is at the beginning of the anterior half of the head. The mouth is oblique and subterminal in adults and most young, oblique and terminal in some young. The mouth extends back to between the nostril and the eye. Lips are thin. The dorsal fin margin is concave. The last dorsal fin unbranched ray is thickened in its lower two-thirds but the last third is thin and flexible. The dorsal fin origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin tip reaches back to almost the mid-anal fin level. The caudal fin is deeply forked with pointed tips. The anal fin is emarginate and does not extend back to the caudal fin base. The pelvic fin is rounded and reaches the anal fin or falls just short. The pectoral fin is rounded and does not reach back to the pelvic fin except in some young fish.

Dorsal fin unbranched rays 3 and branched rays 7-9, usually 8, anal fin unbranched rays 2-4, usually 3, and branched rays 12-19, usually 15-17, pectoral fin branched rays 12-17, and pelvic fin branched rays 7-9, usually 8. Lateral line scales 60-87. There is a large pelvic axillary scale. Scales at the base of the anal fin are somewhat enlarged and may be vertically elongate, forming a sheath. There is an obvious scaleless keel from the pelvic fins to the vent on the belly mid-line. Scale shape is rounded to squarish with rounded posterior, dorsal and ventral margins, the ventral margin sometimes more rounded than the dorsal margin, abrupt but rounded anterior corners, and the anterior margin is wavy, indented shallowly to moderately adjacent to each corner, or a central protrusion with an indentation above and below. The scale focus is sub-central anterior with fine but not numerous circuli and very few posterior radii (less than 10 main radii in the largest fish seen). Gill rakers number 6-12 and are sickle-shaped (Saadati, 1977) but this count presumably includes only lower arch rakers. Total gill rakers number 10-14, are short and only reach the adjacent raker when appressed. The rounded raker has a triangular flap on its internal surface with the tip of the rounded raker projecting. The raker tip may be squarish or even forked in larger fish. The inner edge of the flap is finely tuberculate. Pharyngeal teeth are 2,5-5,2 with variants 2,5-5,1, 1,5-5,2, 1,5-5,1, 3,5-5,2, 2,5-4,2, 2,5-4,1, 2,4-5,1, 2,4-4,1 1,5-4,1, 1,5-4,0, 1,4-5,2, 1,4-5,1 and 2,6-5,2. The teeth are hooked at the tip with an elongate flat area below and the largest tooth may be strongly serrated. The posteriormost major row tooth may be almost vertically above the fourth tooth rather than posterior to it. The gut is relatively short with anterior and posterior loops. Total vertebrae number 40-45. Chromosome number 2n = 50 (Nur *et al*., 2008).

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(1) or 8(52), anal fin branched rays 14(4), 15(23), 16(24) or 17(2), pectoral fin branched rays 14(3), 15(36), 16(11) or 17(3), pelvic fin branched rays 8(53), lateral line scales 60(1), 61(-), 62(2), 63(4), 64(6), 65(11), 66(6), 67(7), 68(4), 69(3), 70(5), 71(-), 72(1) or 73(2), total gill rakers 10(1), 11(4), 12(18), 13(22) or 14(8), pharyngeal teeth modally 2,5-5,2(33) with variants 2,5-5,1(6), 1,5-5,2(3) or 1,5-5,1(2), and total vertebrae 43(2), 44(10) or 45(13).

Sexual dimorphism. Males have the head, nape and dorsal part of the body with large tubercles, there are two rows of tubercles on the pectoral and pelvic fin branched rays and there are tubercles on the free margins of scales in rows. Females also bear tubercles but they are not as well-developed as in males (Küçük *et al*., 2014). Males and females, as well as young, may have fine tubercles distributed over the head and especially well-developed ventrally and even on the lips. Belly and lower flank scales have fine tubercles concentrated at the base of the exposed

scale, some lining the scale margin. Fine tubercles line the dorsal and ventral surfaces of the pectoral and pelvic fins concentrated on rays but also on membranes, in a single file or variably dispersed.

Colour. The back and upper head are olive-green to green or bluish and the upper flank has a golden sheen. Flanks below are silvery and the abdomen is silvery-white. There is a dark and wide stripe (about orbit diameter) on the flank, not always evident in fresh fish. Above the dark stripe is a narrow golden stripe, about one-third orbit diameter. Dorsal and caudal fins have black tips while paired fins can have a reddish or orange base. Dorsal, anal and caudal fins may be tinged reddish, especially near the body. The peritoneum is brown with dark blotches or speckles.

Size. Reaches 25.0 cm. Çakır *et al*. (2016) gave 24.2 cm total length for fish from Lake Çıldır in the Aras River basin of Turkey.

Distribution. In Iran, it is found in the Caspian Sea basin including the Aras (as far down as Karadonly), Marbureh, Qareh Su, Qezel Owzan, Sefid, Shah, Shahrbijar, Siah and Tutkabon rivers, in the Anzali Talab drainage such as the Nahang and Pir Bazar rogas, and in the Nazdik, Sefid (Manjil) and Zire dams on the Sefid River (Abbasi *et al*., 1999; Kiabi *et al*., 1999; Abdoli, 2000; Naderi Jolodar and Abdoli, 2004; Abdoli and Naderi, 2009; Zamani Faradonbeh *et al*., 2015; Asadi *et al*., 2017; Abbasi Ranjbar *et al*., 2018; Aazami and Alavi Yeganeh, 2021; Mouludi-Saleh *et al*., 2021). Records from the middle Aji Chay or Talkheh River near Tabriz and the Zarrineh River of the Lake Urmia basin are presumably of *A. urmianus* (Abdoli, 2000). Found in the Kura River of Azerbaijan as far down as Mingechaur but not the lower reaches.

Zoogeography. This species and its relative *A. urmianus* (formerly in a separate genus *Acanthalburnus*) are restricted to the Caspian Sea basin and the adjacent Lake Urmia basin and are presumably derived from a common ancestor related to the *Alburnoides*-*Alburnus* lineage.

Habitat. This species is found in rivers, streams, lakes, dams and marsh tributaries. Collection data included a temperature range of 5.6-24.5ºC, pH 6.0, conductivity 1.6-1.7 mS, river width up to 80 m, still to fast current, clear or muddy water, mud, clay, sand, pebble or stone bottoms, and a grassy shore.

Küçük *et al*. (2014) reported Aras River, Turkey fish to be in dense populations in sandy and gravel streams at 0.5-1.0 m depths.

Age and growth. Zamani Faradonbeh *et al*. (2015) found a *b* value of 2.429, negative allometric growth, and a condition factor of 0.73 for 22 fish, 30.9-83.3 mm total length, from the Tutkabon River. Asadi *et al*. (2017) gave a *b* value of 3.001 for 17 fish, 1.8-9.0 cm total length, from the Shahrbijar River, Gilan with a total length condition factor of 0.96. The condition factors and *b* values for the Ghezel-Ozan (= Qezel Owzan) and Sefid River populations were 1.06 and 0.96 and 3.24 and 3.15, respectively, the latter both indicating positive allometric growth (Abbasi and Ghafouri, 2020). Eagderi *et al*. (2020) examined 11 fish, 9.19-12.59 cm total length, from the Sefid River and found a *b* value of 2.75, negatively allometric. Mouludi-Saleh *et al*. (2021) examined 98 fish, 6.3-16.6 cm total length, from the Aras, Qezel Owzan and Sefid rivers and recorded a *b* value of 3.28, positive allometric, and a condition factor of 0.99.

Females matured at 2 years in Azerbaijan (Abdurakhmanov, 1962). Türkmen *et al*. (2001) examined 1,105 fish and found them up to 7 years of age in the upper Aras River in Turkey, with three-year-old fish dominant, sex ratio equal, von Bertalanffy growth parameters were L_∞ = 29.87 cm, K = 0.1049, t_o = -1.92, the length-weight relationships for males and females were W = 0.0099L3.098 and W = 0.0118L3.052 respectively, and the condition coefficients of males and females were 1.192 and 1.209 respectively. Females attained a greater

age and size than males. Çakır *et al*. (2016) examined 229 fish, 7.6-24.2 cm total length, from Lake Çıldır, Turkey where age group four was attained with most fish in age group 2 years. The length-weight relationship was $W = 0.0058L^{3.1199}$ and the von Bertalanffy growth parameters were $L_\infty = 38.37$ cm, $K = 0.193$ year^{-1}, $t_0 = -0.73$ years, the growth performance index was $\phi = 2.45$ and Fulton's condition factor was K = 0.75. Total, natural and fishing mortalities were Z = 0.5, M = 0.28, F = 0.22 and exploitation was E = 0.44. The population was not overfished.

Food. Food includes aquatic insects, crustaceans and snails, and detritus. In Lake Çıldır, Turkey fish often do not feed during the May spawning season (Çakır *et al*., 2016).

Reproduction. Spawning probably occurs in the spring judging from fish caught on 31 January 1962 (CMNFI 1970-0536) in Iran which had developing eggs. Fecundity is up to 19,060 eggs and egg diameter to 1.87 mm. In Armenia, maturity is reached at the end of the second year or beginning of the third year at 80-120 mm, and spawning takes place in late April to early May and may continue to late August (Pipoyan and Arakelyan, 1999). In the Turkish Aras, maturity for both sexes began at age 2 years, with all fish mature at 4 years, and spawning started in early May and continued to the end of July. Fecundity reached a mean value of 9,705 eggs and egg size reached 1.65 mm (Türkmen *et al*., 2001).

Parasites and predators. None reported from Iran.

Economic importance. None in Iran. Used locally but not commercially in Lake Çıldır, Turkey (Çakır *et al*., 2016).

Experimental studies. None.

Conservation. Kiabi *et al*. (1999) considered this species to be conservation dependent in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, few in numbers, habitat destruction, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and absent outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

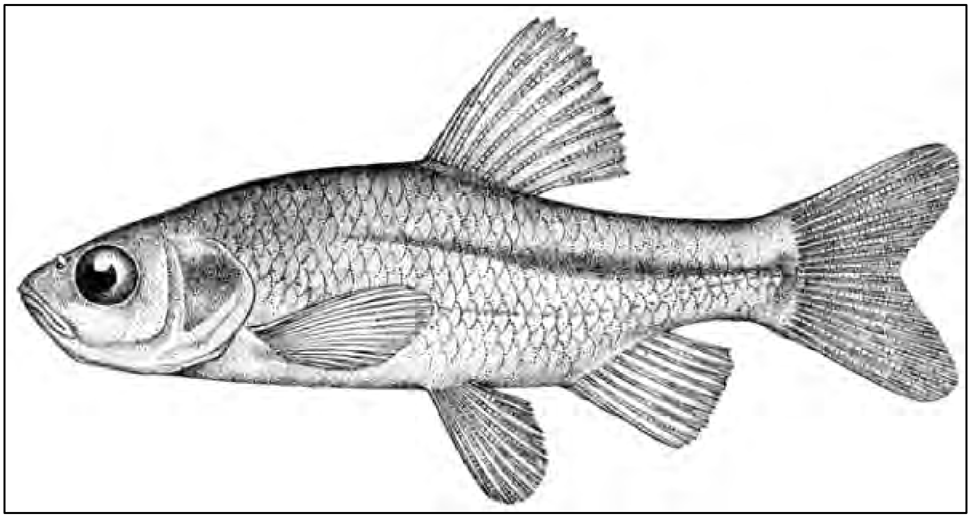
Sources. Type material:- *Alburnus punctulatus* (BM(NH) 1897.7.5:34).

Iranian material:- CMNFI 1970-0522, 2, 55.1-71.3 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0536, 4, 70.9-109.3 mm standard length, Gilan, Siah River estuary near Rudbar (36º53'N, 49º32'E); CMNFI 1970-0538, 1, 70.7 mm standard length, Gilan, Qezel Owzan River above Manjil Dam (ca. 36º44'N, ca. 49º24'E); CMNFI 1970-0583, 11, 39.0-79.9 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1979-0454, 8, 37.7-64.7 mm standard length, Zanjan, Qezel Owzan River at Gilavan (36º47'N, 49º08'E); CMNFI 1979-0455, 7, 50.2-123.3 mm standard length, Qazvin, Manjil Dam (36º45'N, 49º17'E); CMNFI 1979-0695, 15, 71.6-112.7 mm standard length, Gilan, Sefid River at Manjil Bridge (36º46'N, 49º24'E); CMNFI 1980-0116, 1, 75.5 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E).

Comparative material:- CMNFI 1980-0807, 2, 138.2-143.8 mm standard length, Turkey, Ölçek Suyu (no other locality data); CMNFI 1986-0007, 1, 132.2 mm standard length, Turkey, Kars River (ca. 41º00'N, ca. 43º00'E).

Acanthobrama persidis

(Coad, 1981)



Acanthobrama persidis
Charles H. Douglas @ Canadian Museum of Nature.

Acanthobrama persidis, Fars, Ghadamgah Spring-Stream system, Azad Teimori.

Acanthobrama persidis, Fars, Pirbanoo Spring, Jörg Freyhof.

Common names. Arusmahi-ye Fars (= Fars bride fish), ‘Rus mahi persidis (=persidis bride fish), both from Y. Keivany, pers. comm., 25 September 2018.

[Kor bleak, Persian bleak, Persian chub].

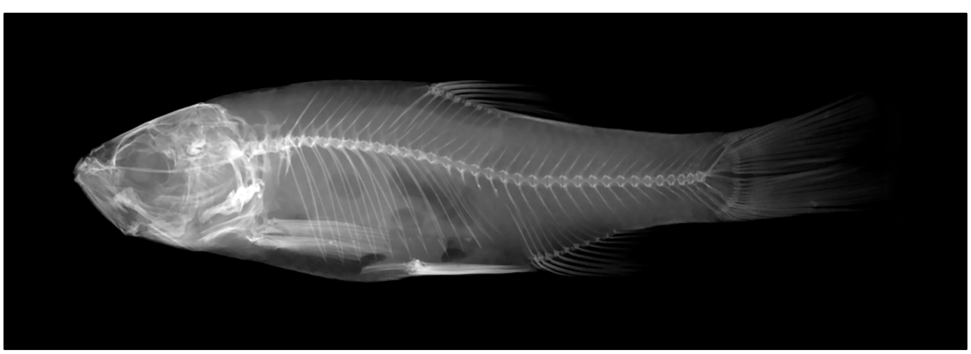
Systematics. Trewavas (1972) discussed the generic nomenclature of *Pseudophoxinus* Bleeker, 1860 in which this species was originally described. It is more closely related to the genus *Leuciscus* according to N. Bogutskaya (pers. comm., 1994, 1996). Bogutskaya (1996)

placed this species in her *Leuciscus borysthenicus* (Kessler, 1859) group which also includes *L. ulanus* and deserved subgeneric rank, but later erected a new genus *Petroleuciscus*. Doadrio and Carmona (2006) placed it in *Squalius*. Perea *et al*. (2010) using mitochondrial and nuclear DNA proposed placing this species in *Acanthobrama*. Teimori *et al*. (2016) confirmed the placement of this species in *Acanthobrama* using mtDNA and material from the Kor River, Lake Maharlu and Persis basins.

Saadati (1977) described, but did not name, a new species in the genus *Phoxinellus* Heckel, 1843 from the Bid Sorkh River in the Simareh River basin between Sahneh and Kangavar in Kermanshah (the Bid Sorkh Pass is at 34°26'N, 47°49'E). I was unable to find this species in his collections and no further material has come to light. It had 8-9 dorsal fin branched rays, 8-9 anal fin branched rays, 8 pelvic fin branched rays, 47-56 scales in a complete lateral line, and 20 long and crowded gill rakers.

The type locality of *Pseudophoxinus persidis* is the "upper Shur River drainage at "Koorsiah" village, near Darab on Darab-Fasa road, 28°45.5'N, 54°24'E, Fars". The holotype is a 54.7 mm standard length male held at the Canadian Museum of Nature, Ottawa under CMNFI 1979-0154A. Paratypes comprise 95 fish, 34.7-58.8 mm standard length, from the same locality as the holotype under CMNFI 1979-0154B, and five fish, 74.7-92.4 mm standard length, under CMNFI 1979-0499 from an "irrigation ditch at village 32 km west of Kor River bridge on road to Dariush Dam, 30°04.5'N, 52°36'E, Fars". Paratypes were distributed to the following institutions from CMNFI 1979-0154B:- BM(NH) (2), ROM (2), UAIC (1), UBC (2) and UMMZ (2).

Pseudophoxinus persidis, holotype, CMNFI 1979-0154A,
James Maclaine @ Canadian Museum of Nature.



Pseudophoxinus persidis, holotype, CMNFI 1979-0154A,
Noel Alfonso @ Canadian Museum of Nature.

Pseudophoxinus persidis, paratype, CMNFI 1979-0154B,
Bronwyn Jackson @ Canadian Museum of Nature.

Key characters. This species is characterised by having a 35-43 lateral line scales, dorsal fin branched rays modally 7, anal fin branched rays 7-9, pharyngeal tooth count of 1,5-4,1, and dorsal fin spine and naked ventral keel absent.

Morphology. Unlike related *Acanthobrama* species it lacks a dorsal fin spine and naked ventral keel. The body is rounded, somewhat compressed and relatively deep. It is deepest a short distance in front of the dorsal fin. The predorsal profile is steeply convex. A small nuchal hump may be apparent in larger fish. The caudal peduncle is compressed and deep. The head tapers to a rounded snout. The mouth is terminal to slightly subterminal, fairly large and quite oblique, and the rictus reaches back to a level just anterior to the anterior eye margin. The eye is well in the anterior half of the head, much more anterior than in *A. urmianus* for example. Lips are of moderate thickness. The dorsal fin origin is slightly behind the level of the pelvic fin origin. The dorsal fin margin is truncate to rounded. The depressed dorsal fin reaches back level with the beginning of the anal fin. The caudal fin is shallowly forked with very rounded tips. The anal fin margin is truncate to slightly rounded. The anal fin does not extend back to the caudal fin base. The pelvic fin has a rounded to straight margin and extends back to the anal papilla or to the anterior anal fin. The pectoral fin is rounded and does not extend back to the pelvic fin. Both the pectoral and pelvic fins can be quite small.

Dorsal fin unbranched rays 3 and branched rays 6-7, usually 7, anal fin unbranched rays 3 and branched rays 7-11, usually 8-9, pectoral fin branched rays 13-15, and pelvic fin branched rays 7-8. Lateral line scales 35-43. A pelvic axillary scale is present. The subcircular to oval scales bear numerous fine circuli and radii on the anterior and posterior fields (total radii number 23-44). The focus is subcentral and slightly anterior. Anterior radii are short, lying in mid-field and not extending to the scale margin or focus, or long and extending to the scale margin but barely reaching the focus. Total gill rakers number 10-14 and reach the adjacent raker when appressed. Pharyngeal teeth are usually 1,5-4,1. Pharyngeal teeth are strongly hooked, concave below the hook and serrated along the margins of the concave surface, particularly on the anterior edge. In the largest fish, the hook may be much reduced to absent, serrations may be absent, and anterior teeth in the main row are rounded. The gut is a short and simple s-shape. Total vertebrae number 34-37. The holotype has 36 total vertebrae.

Meristic values for Iranian specimens are:- dorsal fin unbranched rays 3 and branched rays 6(2) or 7(195), anal fin unbranched rays 3 and branched rays 7(3), 8(41), 9(11), 10(-) or 11(1), pectoral fin branched rays 13(10), 14(20) or 15(20), pelvic fin branched rays 7(31) or

8(19), lateral line scales 35(2), 36(19), 37(4), 38(10), 39(3), 40(6), 41(5), 42(-) or 43(1), total gill rakers 10(1), 11(9), 12(32), 13(6) or 14(2), pharyngeal teeth 1,5-4,1(13), 1,5-4,2(1) or 1,5-4,0(1), and total vertebrae 34(1), 35(20), 36(27) or 37(2). The chromosome number is 2n = 50 (Esmaeili and Piravar, 2006a; Arai, 2011).

Sexual dimorphism. The number of anal fin branched rays is significantly higher in females (mean 8.3 versus 8.0 in males). Pectoral and pelvic fin lengths, longest dorsal and anal fin rays and caudal peduncle length are shorter in females than in males while head length, head width and predorsal length are longer in females than in males.

Colour. The back and upper flanks are dark brown and the belly cream to dark brown. A golden stripe extends from the eye to the caudal peduncle on the upper flank in some live fish (Esmaeili *et al*., 2015). The straight lateral stripe seen in preserved fish is not always evident in live ones (see photograph above). It extends from a diffuse area on the tail base to a level at or in front of the dorsal fin origin but does not reach the head. The stripe overlaps the lateral line on the caudal peduncle but lies above it on the flank, paralleling the back. The iris is golden yellow. Dorsal fin membranes are lightly speckled with melanophores which tend to be concentrated along the fin ray margins. The caudal and anal fin membranes are mostly clear with pigment restricted to fin ray margins. The pectoral fin may be pigmented on the membranes and there is often strong pigment along the posterior edge of the first unbranched ray. The pelvic fin has little or no pigmentation. Large fish are much darker overall than small fish, obscuring the stripe and with more pigment on fin rays and membranes.

Size. Reaches 12.2 cm standard length.

Distribution. This Iranian endemic is found in the Hormuz, Kor River, Lake Maharlu and Persis basins in Iran. Found in the Hormuz basin in the Kul and Shur rivers; in the Kor River basin in the Kor, Pulvar and Shad Kam rivers, Ghadamgah Spring-Stream system, Gomban Spring and Kaftar Lake; in the Lake Maharlu basin at Pirbanoo Spring and Pol-e Berengie; and in the Persis basin in the Dalaki, Helleh, Mond (middle reach) rivers and Dasht-e Arjan (Coad, 1981d; M. Hafezieh, pers. comm.; Abdoli, 2000; Barzegar and Jalali, 2002; Esmaeili *et al*., 2014, 2015; Teimori *et al*., 2010, 2015, 2016; Gholamifard and Kafaei, 2017; Gholamifard and Kafaei, 2021; see photographs above).

Zoogeography. Durand *et al*. (2000) placed this species in a *Leuciscus cephalus* “complex”, i.e., descendants of peripheral isolates of a widespread ancestral species, later re-invaded by Danubian *S. orientalis*. Further work has shown this species belongs in a different genus as outlined above.

Habitat. This species is found in rivers, streams, springs, dams, jubes (= irrigation channels) and qanats. Habitat knowledge is restricted to field data of collections. Habitats have in common a stream-like environment for much of the year. They are relatively shallow (20 cm to 2 m), variable width (0.5-75 m), medium to slow current, cloudy to clear and colourless water, some submergent and emergent aquatic vegetation and a bottom varying from pebbles and gravel to mud. Water temperatures varied from 15 to 23°C from October to January and presumably would be over 30°C in the summer. Conductivity ranged from 0.3 to 1.0 mS. Altitude ranged from 980 to 1,940 m. The lower reaches of some of the capture rivers are salty and may not support this species.

Habitat of *Acanthobrama persidis* (and *Alburnus sellal*) CMNFI 1979-0342,
Fars, Kor River at Band-e Amir, 28 November 1977, Brian W. Coad.

Age and growth. Esmaeili and Ebrahimi (2006) gave a significant length-weight relationship based on 10 fish measuring 4.21-8.33 cm standard length. The *b* value was 3.229. Esmaeili *et al*. (2014) gave a *b* value for 33 fish from the Lake Maharlu basin, 4.51-7.3 cm total length, as 2.83.

Food. Gut contents include insect remains and fragments of large plants. Diet presumably consists mostly of aquatic invertebrates.

Reproduction. Reproduction in this species is unknown but egg development in adult fish collected in winter and young of the year collected in October suggest spring and early summer as the spawning season.

Parasites and predators. Jalali *et al*. (2000) recorded *Dactylogyrus sphyrna*, a monogenean, from the gills of this species in the Kor River basin. Barzegar and Jalali (2002) reported parasites in this species from Kaftar Lake as *Lernaea cyprinacea*, *Trichodina* sp., *Ichthyophthirius multifilis* and *Dactylogyrus sphyrna*. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea foliaceus* on this species.

Economic importance. None.

Experimental studies. None.

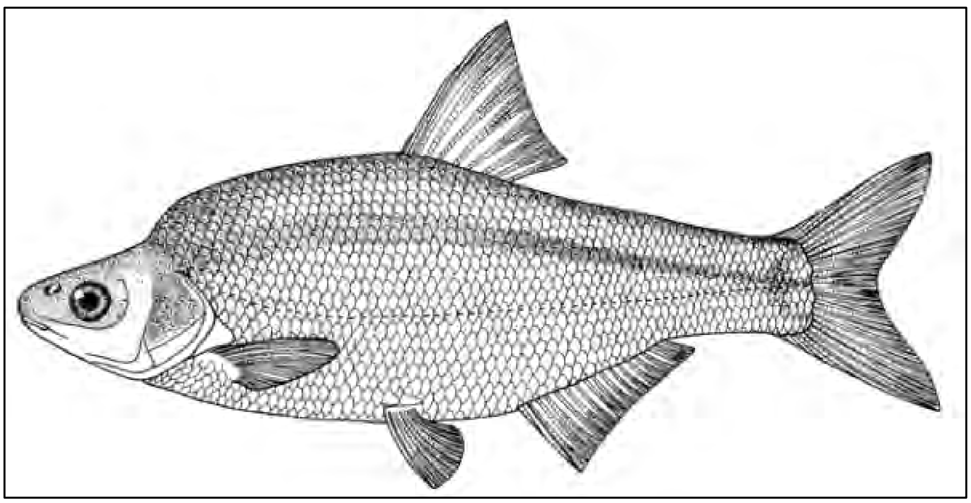
Conservation. The distribution of this species in various small habitats was thought to mean that it was not in immediate danger. However, water is in short supply in this part of Iran and abstraction may threaten its survival. The type locality has dried completely, Lake Maharlu and upper Helleh River basin localities are dried out or under pressure and populations are now restricted to the upper Kor River basin. Even the latter populations are now under threat from *Oncorhynchus mykiss* (rainbow trout), a carnivorous, fish-farm escapee (Teimori *et al*., 2016). Esmaeili *et al*. (2018) stated that there are no recent records from the Hormuz basin. Jouladeh-Roudbar *et al*. (2020) listed it as Critically Endangered for these reasons.

Sources. Type material:- *Pseudophoxinus persidis* (CMNFI 1979-0154A, CMNFI 1979-0154B and CMNFI 1979-0499).

Iranian material:- CMNFI 1979-0025, 11, 19.4-79.6 mm standard length, Fars, Kor River

at Marv Dasht (29º51'N, 52º46'30"E); CMNFI 1979-0114, 1, 47.1 mm standard length, Fars, Mond River at road bridge (29º41'N, 52º06'E); CMNFI 1979-0156, 6, 43.8-64.3 mm standard length, Fars, qanat in Rashidabad (28º47'N, 54º18'E); CMNFI 1979-0163, 8, 31.1-48.3 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0164, 15, 28.8-52.6 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0194, 3, 48.9-58.2 mm standard length, Fars, jube 15 km from Darab (28º45'30"N, 54º24'E); CMNFI 1979-0292, 7, 37.0-54.0 mm standard length, Fars, Lapu'i spring near Zarqan (29º48'N, 52º39'E); CMNFI 1979-0305, 2, 23.8-25.5 mm standard length, Fars, Pulvar River at Pasargad (30º12'N, 53º12'E); CMNFI 1979-0342, 33, 23.6-43.2 mm standard length, Fars, Kor River at Band-e Amir (29º46'N, 52º51'E); CMNFI 1979-0503, 4, 32.2-113.5 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 2008-0250, Fars, 3, 105.5-121.9 mm standard length, Fars, Baleghloo Stream near Eqlid (30º53'56"N, 52º41'12"E); CMNFI 2008-0251, Fars, 3, 83.9-102.8 mm standard length, Fars, Shad Kam River near Eqlid (30º53'38"N, 52º41'42"E); USNM 258445, 18, 15.5-44.5 mm standard length, Fars, Chasht Khvar (ca. 29º44'N, ca. 53º12'E).

Acanthobrama urmianus
(Günther, 1899)



Acanthobrama urmianus
Susan Laurie-Bourque @ Canadian Museum of Nature.

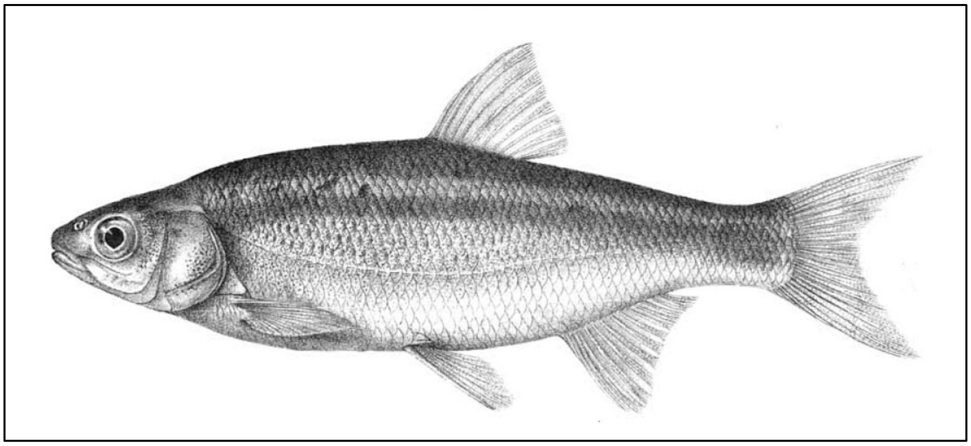
Acanthobrama urmianus, West Azarbayjan, Qader Chay, October 2011, K. Abbasi.

Common names. Kuli-ye Orumiyeh (= Urmia fish), aros or arus mahi Oromiye (= Urmia bride fish).

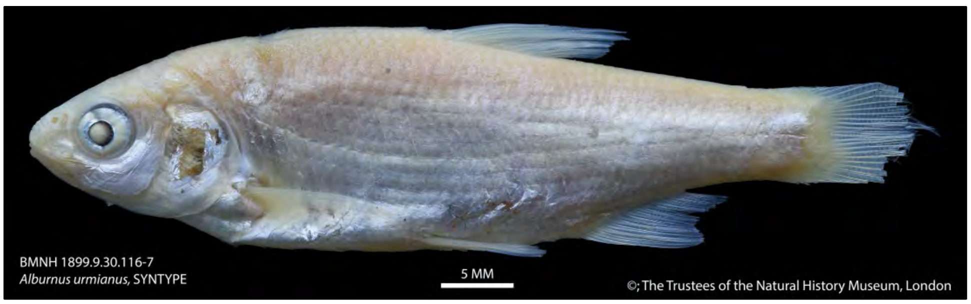
[Urmia or Urmian bleak, Urmia bream, Urmia Lake chub].

Systematics. Originally described in the genus *Abramis* Cuvier, 1816, Berg (1948-1949) placed this species in the genus *Alburnoides* Jeitteles, 1861, and Perea *et al*. (2010) in *Acanthobrama*. Type material in the British Museum (Natural History) was listed under the genus *Alburnus* (see photographs below).

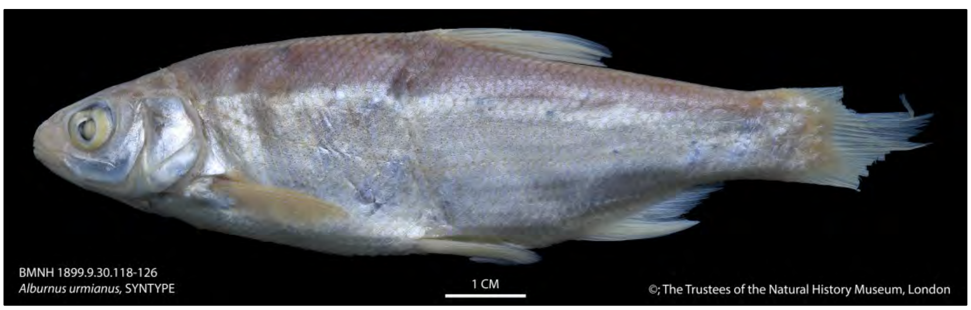
The type material in the Natural History Museum, London comprises two specimens, 54.9-58.6 mm standard length, from the Urmi River (BM(NH) 1899.9.30:116-117), one specimen, 111.7 mm standard length, from the Ocksa River (BM(NH) 1899.9.30:118) (these three fish being labelled paralectotypes, with 118 being the lectotype, by P. M. Bănărescu in 1980), and eight specimens, 50.5-111.7 mm standard length, from the Ocksa River (BM(NH) 1899.9.30:119-126), these being syntypes. Günther (1899) referred to the type series as “Five specimens from the Gader Chai (= Qader Chay or River) and two small ones from the Urmi River; the largest is only 144 millim. Long” so there is some confusion over this material. Oksa (or Ocksa) is a label on the map by Günther (1899) (see description of the Lake Urmia basin) and is in the Qader Chay or River basin but is not coloured blue like other rivers. The label seems part of the location Plain of Solduz. The Urmi River may be the Shahr Chay or River running through the city of Urmi.



Abramis urmianus, syntype, after Günther (1899).



Abramis urmianus, syntype, BM(NH) 1899.9.30:116-117.



Abramis urmianus, syntype, BM(NH) 1899.9.30:118-126.

Key characters. This species is distinguished from the related *A. microlepis* by having fewer lateral line scales, fewer anal fin branched rays, more gill rakers and gill raker morphology according to Saadati (1977). Gill raker morphology does not appear to differ in the fish examined by me. Gill raker counts are the same but scale and anal fin ray counts are generally lower with some overlap. Distribution is the easiest separating factor.

Morphology. The body is compressed and moderately deep, being deepest in front of the dorsal fin over the end of pectoral fin. A nuchal hump is present in larger fish. The predorsal fin profile is convex. The caudal peduncle is compressed and fairly deep. The dorsal head profile is straight and leads to a rounded snout. The rear of the eye is at the beginning of the anterior half of the head. The mouth is oblique and subterminal and extends back to a level between the nostril and the eye. Lips are of moderate thickness. The dorsal fin has a moderate spine and the dorsal fin margin is straight to slightly emarginate. The dorsal fin origin is slightly posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back to a level just past the

anal fin origin. The caudal fin is moderately to deeply forked with rounded lobes. The anal fin margin is concave and the depressed fin does not reach back to the caudal fin base. The pelvic fin is rounded and almost extends back to the anal fin origin in some or is remote in others. The pectoral fin is rounded and does not extend back to the pelvic fin origin.

Dorsal fin with 3 unbranched and 7-9, usually 8, branched rays, anal fin with 3 unbranched and 10-13 branched rays, pectoral fin branched rays 14-16, and pelvic fin branched rays 7-8. Lateral line scales 50-68. A pelvic axillary scale is present. The ventral keel extends from the anus to the base of the pelvic fins and is fleshy from half way to the whole length. One specimen (CMNFI 2008-0137) was scaled in the middle of the naked ventral keel. Scale shape is squarish, the posterior margin is rounded, the dorsal and ventral margins are straight to slightly rounded, the anterior corners are rounded to very abrupt with a rounded point, and the anterior margin is irregular, wavy and rounded, or almost vertical with a central protrusion and an indentation above and below. Scales bear only a few posterior radii and have a subcentral anterior focus. Total gill rakers number 10-14, and are short, not quite or just reaching the adjacent raker when appressed; rounded with a projected tip and distinct from its congener according to Saadati (1977) but closely resembling the structure seen in *A. microlepis* according to my observations (see above under *A. microlepis*). Pharyngeal teeth are usually 2,5-5,2 or 2,5-4,2 with variants 2,4-5,2, 1,5-4,2 or 2,4-4,2. Posterior teeth are hooked at the tip, anterior teeth being rounded, and have no, slight, moderate or even strong serrations. There is a narrow and slightly concave surface below the tip. Some fish have the anterior margin of the concave surface higher than the posterior margin, but this is variable and in some teeth the condition is the reverse. The intestine is an elongate s-shaped with a small anterior loop. Total vertebrae number 41-43.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(1), 8(20) or 9(1), anal fin branched rays 10(1), 11(4), 12(11) or 13(6), pectoral fin branched rays 14(4), 15(17) or 16(1), pelvic fin branched rays 7(3) or 8(19), lateral line scales 50(1), 51(-), 52(2), 53(2), 54(-), 55(1), 56(1), 57(2), 58(-), 59(2), 60(3), 61(3), 62(2), 63(1), 64(1) …. or 68(1), total gill rakers 10(1), 11(2), 12(6), 13(8), or 14(5), pharyngeal teeth 2,5-5,2(1), 2,5-4,2(1), 2,4-5,2(1) or 2,4-4,2(1), and total vertebrae 41(5), 42(7) or 43(2).

Sexual dimorphism. Male fish bear tubercles but fully tuberculate fish have not been examined. One male had a single row of tubercles on anterior pectoral fin rays.

Colour. Overall colour is silvery with a greenish-olive back and flanks with numerous minute brown pigment spots which are crowded above the lateral line to form an inconspicuous darker stripe along the whole side. The dorsal fin may have a reddish base immediately adjacent to the body. The dorsal, caudal and pectoral fins have a light to evident speckling of melanophores on the rays and membranes but are almost immaculate in preserved specimens. Larger fish have pigment proximally on the anterior anal fin rays. The peritoneum is silvery but densely speckled with melanophores.

Size. Reaches 20.8 cm total length (Mouludi-Saleh *et al*., 2021).

Distribution. This species is endemic to the Lake Urmia basin, apparently in southern and western tributaries according to Günther (1899). Records of *A. microlepis* from the middle Aji Chay or Talkheh River near Tabriz are presumably of *A. urmianus* (Abdoli, 2000). It is found in the Aji, Bitas, Hasanlu, Mahabad, Mardogh, Nazlu, Ocksa, Qader, Rozeh, Saqqez, Shahr, Simineh, Urmia and Zarrineh rivers, and the Cheragveis, Hasanlu, Kazemi (or Shahid Kazemi) and Mahabad dams (Abdoli, 2000; Mirhasheminasab and Pazooki, 2003; Abbasi *et al*., 2005; Abdoli *et al*., 2008; Ghasemi *et al*., 2015; Abbasi Ranjbar *et al*., 2018; Fathi and Ahmadifard,

2019).

Zoogeography. The closest relative, *Acanthobrama microlepis*, is found in the Caspian Sea basin. Connections between the Lake Urmia basin and the Caspian Sea basin have been suggested by Saadati (1977), an early one in the Pliocene to early Pleistocene resulting in endemic species and a later one in the late Pleistocene resulting in species which are the same as the Caspian or only subspecifically distinct. This species presumably dates from the earlier connection (but see the Lake Urmia drainage basin account for more details).

Habitat. This species is found in rivers, lakes and dams but details of habitat requirements are unknown.

Age and growth. Fish are mature at 14.4 cm. This species is relatively fast-growing, short-lived species with males attaining 6^+ years and females 7^+ years in the Kazemi Dam on the Zarrineh River where Abdoli *et al*. (2008) examined 1,510 fish ca. 7.3-20.7 cm total length. The von Bertalanffy growth curve was estimated as K = 0.427 in males and 0.506 in females, indicating that females grow faster. The sex ratio was 598:912 male:female (1:1.53) and there were no significant differences between males and females in the linear length-weight relationships. Mouludi-Saleh *et al*. (2021) examined 168 fish, 5.9-20.8 cm total length, from the Mahabad River and recorded a *b* value of 3.15, positive allometric, and a condition factor of 1.09.

Food. Guts examined were empty except for a few plant and crustacean remains.

Reproduction. Sarpanah *et al*. (2021) examind 107 fish from the Mahabad and Simineh rivers and found maturity stages 4 and 5 showed an absolute fecundity of 1,567 to 27,228 eggs with a diameter of 0.35 to 1.42 mm and a relative fecundity of 87.9 to 633.9 eggs/g body weight. The results also showed that the rate of fecundity in the Mahabad River in the constant length range was less than in the Simineh River.

Parasites and predators. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea* sp. and *Ergasilus* sp. on this species.

Economic importance. None.

Experimental studies. None.

Conservation. This species is known only from the type series and a few other specimens in museum collections. Listed as Data Deficient by the IUCN (downloaded 25 February 2019) but as Endangered by Jouladeh-Roudbar *et al*. (2020) because of dam construction and drought causing many rivers to dry out for most of the year. Jouladeh-Roudbar *et al*. (2020) indicated the species is now known only from the Gedar (= Qader) and Zarrineh rivers with an area of occupancy less than 500 sq km. The middle and lower parts of this river (*sic*, presumably both) have no water flow in summer and any further reductions would lead to extinction.

Sources. Type material:- *Abramis urmianus* (BM(NH) 1899.9.30:116-117, BM(NH) 1899.9.30:118 and BM(NH) 1899.9.30:119-126).

Iranian material:- CMNFI 1979-0093, 2, 127.5-130.5 mm standard length, West Azarbayjan, Lake Qowpi (36º57'N, 45º52'E); CMNFI 2007-0098, 1, 156.3 mm standard length, West Azarbayjan, river south of Mahabad (ca. 36º42'N, ca. 45º41'E); CMNFI 2007-0101, 1, 129.3 mm standard length, West Azarbayjan, Simineh River south of Miandow Ab (ca. 36º54'N, ca. 46º07'E); CMNFI 2007-0105, 1, 90.8 mm standard length, Kordestan, Zarrineh River basin south of Saqqez (ca. 36º06'N, ca. 46º20'E; CMNFI 2008-0137, 1, 130.7 mm standard length, West Azarbayjan, Zarrineh River (37º05'N, 45º44'E); CMNFI 2008-0158, 1, 85.9 mm standard length, Lake Urmia basin (no other locality data); USNM 205904, 1, 84.7 mm standard length,

West Azarbayjan, Nazlu Chay near Urmia (37º40'N, 45º05'E); USNM 205934, 2, 94.5-141.9 mm standard length, West Azarbayjan, Lake Qowpi (36º57'N, 45º52'E).

Genus *Alburnoides*
Jeitteles, 1861

This genus is found in Europe, Asia Minor and Central Asia with about 35 species, with about 9-14 in Iran, depending on varying interpretations of DNA data and possible undescribed species. Several species were initially described based on morphology with attention to a particular suite of characters, e.g., vertebral counts, and this data is repeated here with later DNA information confirming some and questioning others.

The riffle minnows or spirlins are similar in appearance to the genus *Alburnus* but have smooth rather than serrated pharyngeal teeth. Certainly, it is not uncommon to find individuals of *Alburnus hohenackeri* lacking serrations on their pharyngeal teeth. Arguably then, this distinction is insufficient to warrant a separate genus but molecular evidence sets *Alburnoides* apart from *Alburnus*.

Spirlin is a European name for these fishes, used in English as the genus does not occur in the British Isles.

Pharyngeal teeth in *Alburnoides* are in two rows (2,5-4,2) with strongly hooked tips but unserrated, scales of medium size, no groove before the dorsal fin, a keel behind the pelvic fins is usually scaleless but may be wholly scaled, short dorsal and moderate to long anal fin, last dorsal fin unbranched ray thickened, decurved lateral line often with a characteristic spotting pattern above and below each pore (a stitch-like pattern, hence the Farsi name tailor fish), gill rakers short and few, an absolutely and relatively elongated predorsal vertebral subregion (to 15-17 vertebrae which is commonly over 38% of total and 70% of abdominal vs. 33-37% and 60-66%, respectively, in most other groups of the Leuciscinae), a tendency to equality of the numbers of vertebrae in the abdominal and caudal regions (modal difference between abdominal and caudal numbers decreases from 4 or 3 to 1, 0, and [-1] versus modes 4 to 6 in the most Leuciscinae), and a large orbit with respective configuration of all the cranial elements it is formed from (Bogutskaya and Coad, 2009).

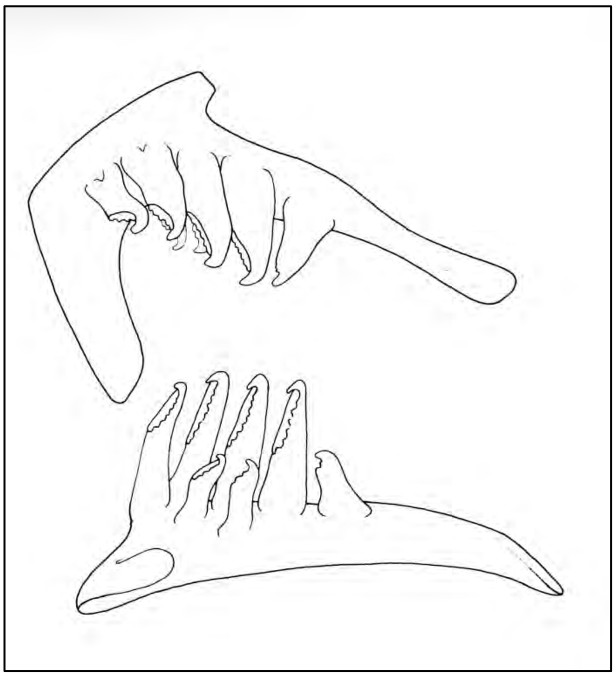
Scale morphology in these fishes is similar between species and is summarised as follows. Scale shape is a vertical oval to sub-squarish and in the latter case the anterior corners may be weakly developed (probably size-related, larger fish having squarer scales). The dorsal and ventral margins are rounded, the posterior margin is rounded and may protrude and the anterior margin is wavy, rounded or with a slight central protuberance. Circuli are moderate to many in number (presumably age related). Radii are few in number and only on the posterior field, encroaching laterally in some fish. The focus is subcentral anterior.

Jouladeh-Roudbar *et al*. (2020) noted that the species are very similar to each other and morphological characters overlap so distribution is important in differentiating species in the field and from preserved material. This works well where isolated basins in Iran are considered but some species may overlap (*eichwaldii* and *samiii* in the western Caspian Sea, *samiii* and *tabarestanensis* in the central Caspian Sea, and possibly *idignensis* and *nicolausi* in the Tigris River basin), and some confusion may result from translocations with commercial cyprinoids. DNA data may be necessary to clarify occurrence in border zones.

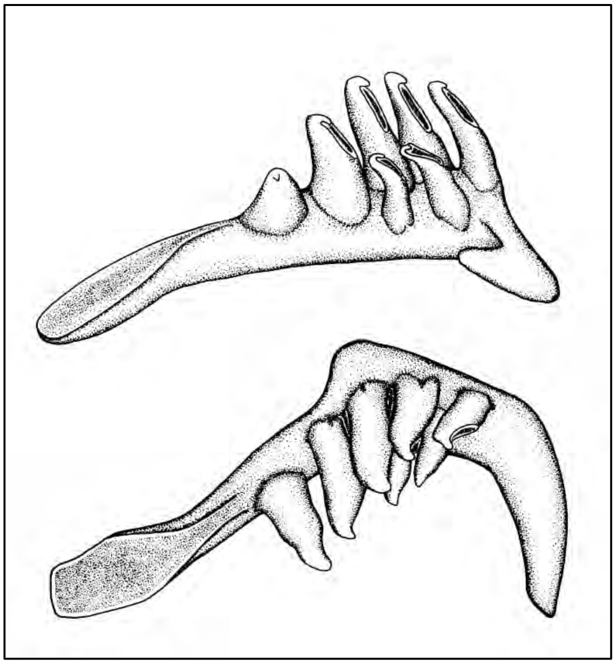
Morphology is given in such works as Bogutskaya and Coad (2009), Mousavi-Sabet *et al*. (2015) and Jouladeh Roudbar *et al*. (2016) and these works should be referred to for further information. It is probable that subtle details of morphology could be teased out of adequate

samples, but these would have to very large to allow for variation due to age, size, sex, condition, season, habitat, preservation techniques, and possible genetic isolation in remote drainages, and this is not attempted here.

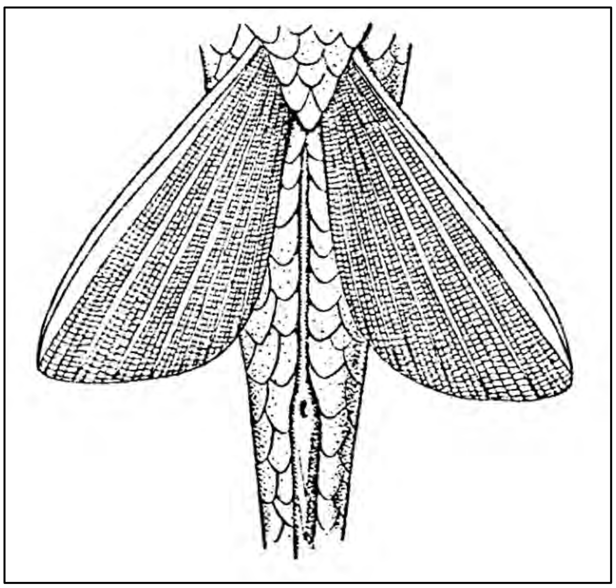
Bogutskaya and Coad (2009) found no differences in the shape of pharyngeal teeth that could be used to diagnose species and the Iranian species they examined were characterised by 2,5-4,2 counts. Most species have strong mode of 8 dorsal fin branched rays, *A. idignensis*, *A. petrubanarescui* and particularly *A. nicolausi* from Iran with high or modal frequencies of 7 rays being exceptions. Anal fin branched ray counts overlap although in the past they have been used as diagnostic characters. The Iranian species *A. petrubanarescui* with a mode of 9 and *A. nicolausi* with a mode of 10 are the lowest recorded. Cephalic lateral line canal patterns and counts were not diagnostic for species. Vertebral characters were dealt with in some detail by Bogutskaya and Coad (2009), which should be consulted, and provide reliable, statistical differences between species. As these are internal characters and require x-ray facilities to examine, they are not of use in the field and are inconvenient for rapid identification of preserved material.



Alburnus sp., serrated pharyngeal teeth,
Freidhelm Krupp.



Alburnoides sp., unserrated pharyngeal teeth,
Freidhelm Krupp.



Complete keel behind pelvic fins in an
Alburnoides species, after Nikol'skii (1938).

Alburnoides bipunctatus (Bloch, 1782) was the name applied to most populations across Europe and the Middle East from France north of the Alps eastwards to the Black, Caspian and Aral Sea basins and inland waters of Iran, and *A. b. eichwaldii* was recognised as the subspecies for Iran but recent research has revealed a greater diversity (Bogutskaya and Coad, 2009; Coad and Bogutskaya, 2009; Seifali, 2012; Seifali *et al*., 2012; Mousavi-Sabet *et al*., 2015, 2015; Jouladeh-Roudbar *et al*., 2016). Preserved specimens and literature records under the names *A. bipunctatus, A. b. eichwaldii* or *A. eichwaldii* have been re-assigned to the newer species based mainly on distribution.

Seifali (2012) studied this genus in Iran and found three clades: southern Caspian Sea, Namak Lake and Kor River basins, and Kavir and Tigris River basins. Jafari *et al*. (2014) found morphometric differences between *A. eichwaldii*, *A. namaki*, *A. nicolausi* and *A. idignensis* and between two populations in the Sefid River basin. Saifali and Yazdani Moghaddam (2014) analysed cytochrome *b* in Iranian Caspian Sea *Alburnoides* finding two major groups, western and Talar River populations considered to be *A. eichwaldii* and eastern populations perhaps being a distinct taxon. The Talar River is in the eastern Caspian Sea however.

Esmaeilipoor Poode *et al*. (2015) examined fish from the Aras (= *A. eichwaldii*), Babol and Tajan (both = *A. tabarestanensis*) rivers using meristics and morphometrics finding high overlap in the former and some distinction in the latter when analysed using multivariate statistics.

Omelchenko (2016) studied *Alburnoides* from Azerbaijan using both mitochondrial (cytochrome b, cytochrome oxidase subunit I) and nuclear (RAG1, rhodopsin) markers. Lineage richness within the samples from the Talysh (= Talish) Mountains hydrological network bordering the northwestern Caspian coast of Iran probably showed evidence for the existence of a glacial refugium in the region. Cytochrome *b* sequences submitted to GenBank by Seifali *et al*. (2012) from the Kaslian River, Mazandaran in the eastern part of the Caspian Sea formed a very well supported independent branch but fell within a clade from the Talish Mountains of Azerbaijan and requires further study. One sequence from M. Seifali had an Iranian origin in the Ab Parran River, Golestan which also flows into the eastern part of the Caspian Sea. It belonged to a clade formed by vouchers (*A. fasciatus*, *A. tzanevi*) from Russia and samples from the northern part of Azerbaijan. The appearance of a voucher from Iran in the clade formed by fish collected in the north of the Greater Caucasus range also requires further study. Interestingly, three samples from Istisuchay River, a tributary of the Astara River which forms part of the Iran-Azerbaijan border, all fell in different clades. It was considered unlikely that three sympatric species of the same ecological niche would inhabit one small river. Furthermore, the species were not distinguishable in the field based on morphological characters, so the existence of three independent lineages remained cryptic. Evidently, much more work needs to be done on *Alburnoides* DNA.

Stierandová *et al*. (2016) carried out a multilocus assessment of nuclear and mitochondrial sequences on European *Alburnoides*, revealing 17 Eurasian lineages with two main clades, the European and Ponto-Caspian. One lineage was identified as *A. eichwaldii* from Kura River specimens, and three un-named lineages from the Gorgan, Sefid and Talar rivers based on Seifali *et al*. (2012). The Sefid River fish are now *A. samiii* and the Gorgan and Talar rivers would be *A. tabarestanensis*. Stierandová *et al*. (2016) considered the Sefid River fish not to be *A. eichwaldii* and this species was absent from Iran in contrast to the conclusions of Seifali *et al*. (2012). From a biogeographical viewpoint, the locations of lineage richness in most cases corresponded to confirmed glacial refugia (Stierandová *et al*. 2016).

Jouladeh Roudbar *et al*. (2016) examined the genus *Alburnoides* using the COI barcode region and found four lineages, one of which was the Iranian *Alburnoides* or *Alburnoides eichwaldii* lineage. In this lineage, *A. holciki* was a sister (supported with a high posterior probability to all other species including *A. eichwaldii* plus *A. qanati* (the most northern and southern *Alburnoides* species of Iran respectively)) and a group comprising *A. idignensis*, *A. nicolausi*, *A. tabarestanensis*, *A. samiii*, *A. damghani*, and *A. namaki*. Two species from the Tigris River basin, *A. idignensis* and *A. nicolausi*, were very closely related and were not well supported as sister taxa (low posterior probability of 0.62). However, the ancestral node for *A. idignensis* was 1.0, as was the ancestral node for *A. nicolausi*, which was strong support for monophyly of each of these species. See also comments by Eagderi *et al*. (2019) under the *A.*

nicolausi account below. *A. damghani* (Damghan River drainage, Dasht-e Kavir basin) was sister (posterior probability = 0.999) to *A. coadi* from the Nam River, a tributary of the Hableh River drainage (Dasht-e Kavir basin) and *A. namaki* from the Qareh Chai (= Chay) River drainage (Namak Lake basin). Hableh River (Dasht-e Kavir basin) fish elements were much closer to those from the Qom River drainage (Namak Lake basin) than to the other river systems of the Dasht-e Kavir. The validity of *A. eichwaldii* from the Kura River was supported by the COI barcode region.

Alburnoides bipunctatus armeniensis Dadikyan, 1972 from Rivers Arpa, Vorotan, Vedi, Marrik, Kasakh, and their tributaries (Aras River system, Kura River drainage) is a synonym of *A. eichwaldii* according to Bogutskaya and Coad (2009), this being supported here by Jouladeh Roudbar *et al*. (2016) using COI barcode region of four fresh collected specimens from two localities in the Aras River (near the cities of Poldasht and Parsabad, border of Iran and Azerbaijan).

Hoshyar *et al*. (2017) used cytochrome *b* sequencing on fish from five Caspian Sea basin rivers and found three clades:- I, Zalki and Safa rivers (Sefid River basin) recognised as *A. eichwaldii* (now *A. samiii*), II, Kelisiyan River (presumably Kesilian), and III, Gorgan and Madar Su (Gorgan River basin), the last two recognised as *Alburnoides* spp. (now *A. tabarestanensis*).

Boroumandi *et al*. (2018) used the COI gene sequence to compare Iranian *Alburnoides*. On the phylogram *A. samiii*, *A. tabarestanensis*, *A. idignensis*, *A. namaki* and *A. coadi* were nested in a monophyletic group with 92 percent boot-strap support. *Alburnoides samiii* had the highest K2P genetic distance to *A. eichwaldii* (4%) and had the least genetic distance to *A. idignensis* and *A. nicolausi* (2.6%). The highest K2P genetic distance was between *A. tabarestanensis* and *A. eichwaldii* (5.2%) and the least K2P genetic distance was between *A. namaki* and *A. coadi* (0.5%).

Levin *et al*. (2018) tested the mitochondrial cytochrome c oxidase subunit I (COI) used as a DNA barcode marker on Caucasian *Alburnoides* and found species identification to be 100%, although they noted the limited ability of COI to infer phylogenetic relationships as did Nazari *et al*. (2021).

Eagderi *et al*. (2021) used a landmark-based geometric morphometric technique to analyse Iranian *Alburnoides* species. Cluster analysis showed two groups, *A. nicolausi* with *A. qanati* and the rest. Both these species were well-separated in the analysis from the each other and from other species. The greatest Mahahlanobis distance was obtained between *A. holciki* and *A. nicolausi*.

In Iran, *Alburnoides* species are one of two most abundant taxa in Caspian rivers along with *Capoeta capoeta* (*sic*, presumably *C. razii*) (*Iranian Fisheries Research and Training Organization Newsletter*, 19:4, 1998).

The chromosome number for *Alburnoides* species is probably 2n = 50, as it is for most related *Alburnus* species. Nazari *et al*. (2009) gave further details for fish identified as *A. bipunctatus* (= *A. samiii*) from the Anzali Wetland and cited this number for *Alburnoides* (now *Alburnus*) *taeniatus* also. Khosravanizadeh *et al*. (2013) gave a chromosome number of 2n = 50 for fish identified as *A. bipunctatus* from Zabol in Sistan, presumably introduced fish from the Caspian Sea basin, the species identity being uncertain.

Abdoli (2000) listed Simuliidae, Plecoptera, Ephemeroptera, Chironomidae and Trichoptera as food for fish identified as *A. bipunctatus,* presumably including many of the species considered below.

Records of parasites for fish identified as *A. bipunctatus* in Iran were as follows:- Jalali

and Molnár (1990a) recorded the monogeneans *Dactylogyrus alatus* and *D. chalcalburni* from this species in the Zayandeh River. Masoumian and Pazooki (1998) surveyed myxosporeans in this species (i.e., both *A. samiii* and *A. tabarestanensis* respectively) in Gilan and Mazandaran provinces, finding *Myxobolus ellipsoides*. Mehdipoor *et al*. (2004) recorded the monogeneans *Dactylogyrus alatus*, *D. chalcalburni* and *D. pulcher* in the Zayandeh River. Gussev *et al*. (1993b) also reported the latter species and locality.

A record of *A. bipunctatus* from a qanat at Hormak (29°58'N, 60°51'E) in the Sistan basin by Saadati (1977) is probably an error of labelling or sorting. It is not mentioned in the collector's (R. J. Behnke) original field notes nor in a typed version. Also, this species was not collected there by me. Khosravanizadeh *et al*. (2013) reported on fish identified as *A. bipunctatus* from Zabol in Sistan, presumably introduced from the Caspian Sea basin, and therefore possibly *A. samiii*, *A. tabarestanensis* or *A. eichwaldii*.

A new species, *Alburnoides diclensis* Turan, Bektaş, Kaya and Bayçelebi, 2016, was described from the upper Tigris River basin of eastern Turkey in the Great Zab River drainage. Whether it occurs in Iran in more southern tributaries of the Tigris River remains to be seen, as the Great Zab distribution precludes this.

An *Alburnoides* species was collected from the Esfahan basin (CMNFI 1979-0266, 2, 32.8-51.5 mm standard length, Esfahan, spring at Nowqan (ca. 33º10'N, ca. 50º05'E) in the Pelasgan River basin which drains to the Zayandeh River) but has not been examined in detail. Principal meristic characters overlap with other *Alburnoides* species and DNA work is required. It may prove to be a distinct species.

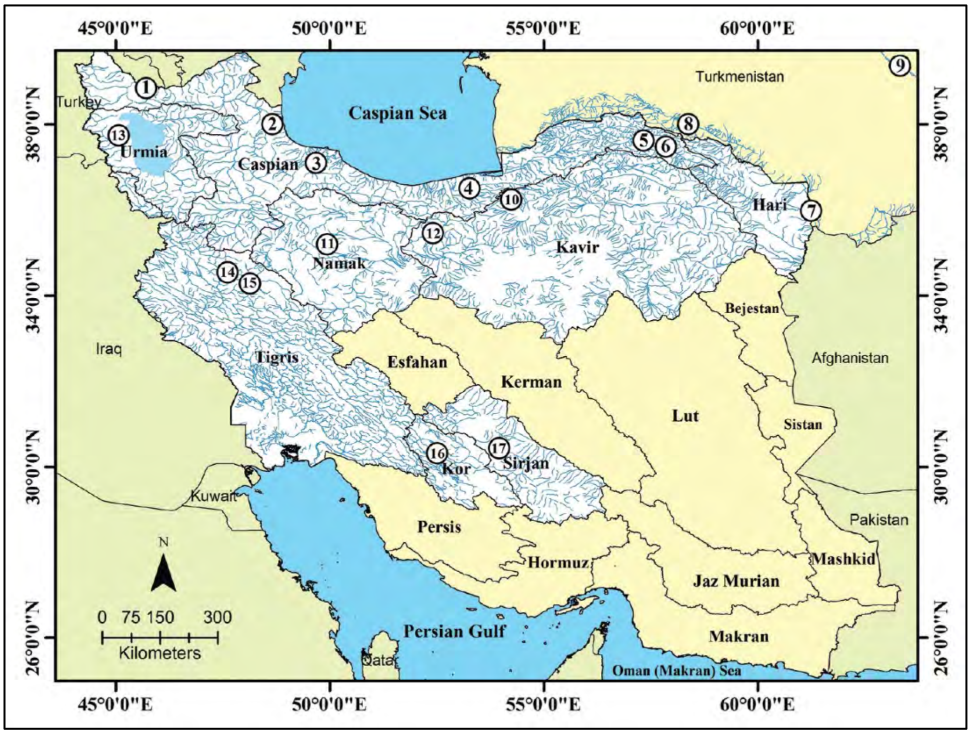
Records of an *Alburnoides* species from the Persis basin are given in the database generated by Mostafavi *et al*. (2014, 2015, 2015), from the Shapur, Shiv (= Tang-e Shib) and Zohreh rivers, and from Dasht-e Arzhan. A single small specimen (CMNFI 1979-0399, 1, 25.9 mm standard length, Fars, Tang-e Shib River in the Zohreh River drainage (30º19'30"N, 51º15'E)) was collected. The identity of this material needs further work as above.

The following table and map summarise the distribution of the Iranian species of *Alburnoides* as meristic and morphological characters overlap. *A. eichwaldii* and *A. samiii* are species with large sample size and serve to show variation within a taxon of meristic counts (see species accounts below). *Alburnoides* species in Iran have modally 8 dorsal fin branched rays (*A. nicolausi* has 7 in 91.3% of fish), 8-16 anal fin branched rays (*A. nicolausi* has 8-11 with 76.3% with 8-10, and *A. petrubanarescui* has 8-13 with 79.6% with 8-10, other species having mostly 11 or more), 39-56 lateral line scales, 5-10 total gill rakers, 2,5-4,2 pharyngeal teeth, and 37-43 total vertebrae. Distribution is key and, as noted above, earlier records are assigned to current species mostly on distributional grounds. Authors vary in recognition of species and putative synonyms are included here. Two potential species are added at the bottom of the table; these require material and DNA analyses to be verified.

I have retained all the newly-described Iranian *Alburnoides* species (11 from 2009 to 2016). Some of the species are founded on morphology, others on morphology and molecular data (usually a single mitochondrial gene). A robust phylogenetic treatment would require sequence data from many more genes than the one gene usually presented (see Liu *et al*. (2017)). More molecular sequence data, such as that from nuclear genes, would help clarify distinctions and potential synonyomies.

Species/Characters	Synonym of	Distribution
Al. coadi	*Al. namaki*	Hableh and Nam rivers, western Dasht-e Kavir
Al. damghani	*Al. namaki*	Cheshmeh Ali and environs, northern Dasht-e Kavir

Al. eichwaldii	-	Caspian Sea (Aras River and possibly western Caspian Sea)
Al. holciki	-	Hari River
Al. idignensis	*Al. nicolausi*	Tigris River (except Nurabad River)
Al. namaki	-	Namak Lake
Al. nicolausi	*Al. idignensis*	Tigris River (Nurabad River)
Al. parhami	*Al. holciki*	Caspian Sea (Atrak River)
Al. petrubanarescui	-	Lake Urmia
Al. qanati	-	Kor River, Sirjan
Al. samiii	-	Western Caspian Sea (Sefid River or just east and then west)
Al. tabarestanensis	-	Eastern Caspian Sea (east of Sefid River)
Al. sp. Esfahan	-	Esfahan
Al. sp. Persis	-	Persis

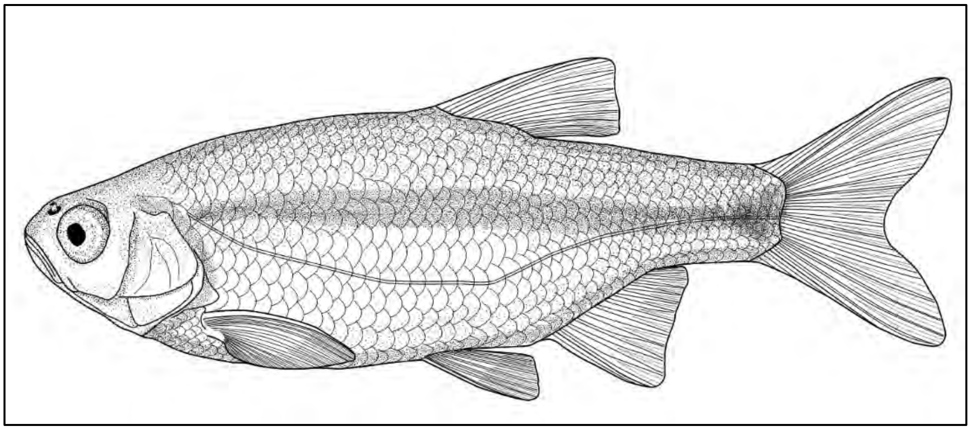


Distribution of *Alburnoides* species in Iran and neighbouring countries, caption modified after Jouladeh Roudbar *et al*. (2016).

1. *A. eichwaldii*: Aras River, Kura River drainage; 2. *A. cf. eichwaldii*: west of Safid River and here mostly *A. samiii*; 3. *A. samiii*: Safid River; 4. *A. tabarestanensis*: Tajan River; 5. *A. parhami*: Atrak River; 6. *A. parhami*: type locality Baba-Aman stream; 7. *A. holciki*: Hari River; 8. *A. varentsovi*: Ashkhabadka River, northern slope of Kopetdag Mountains (not in Iran); 9. *Alburnoides* sp. Amu Darya River (not in Iran); 10. *A. damghani*: Cheshmeh Ali, Damghan River system, Dasht-e Kavir basin; 11. *A. namaki*: Qareh Chay, Namak Lake basin; 12. *A. coadi*: Nam River, Dasht-e Kavir basin; 13. *A. petrubanarescui*: Lake Urmia basin; 14. *A. nicolausi*: Nurabad River, Tigris River system; 15. *A. idignensis*: Tigris River system; 16. *A. qanati*: Pulvar River, Kor River system and 17: Sirjan basin.

Alburnoides coadi

Mousavi-Sabet, Vatandoust and Doadrio, 2015



Alburnoides coadi
Susan Laurie-Bourque @ Canadian Museum of Nature.

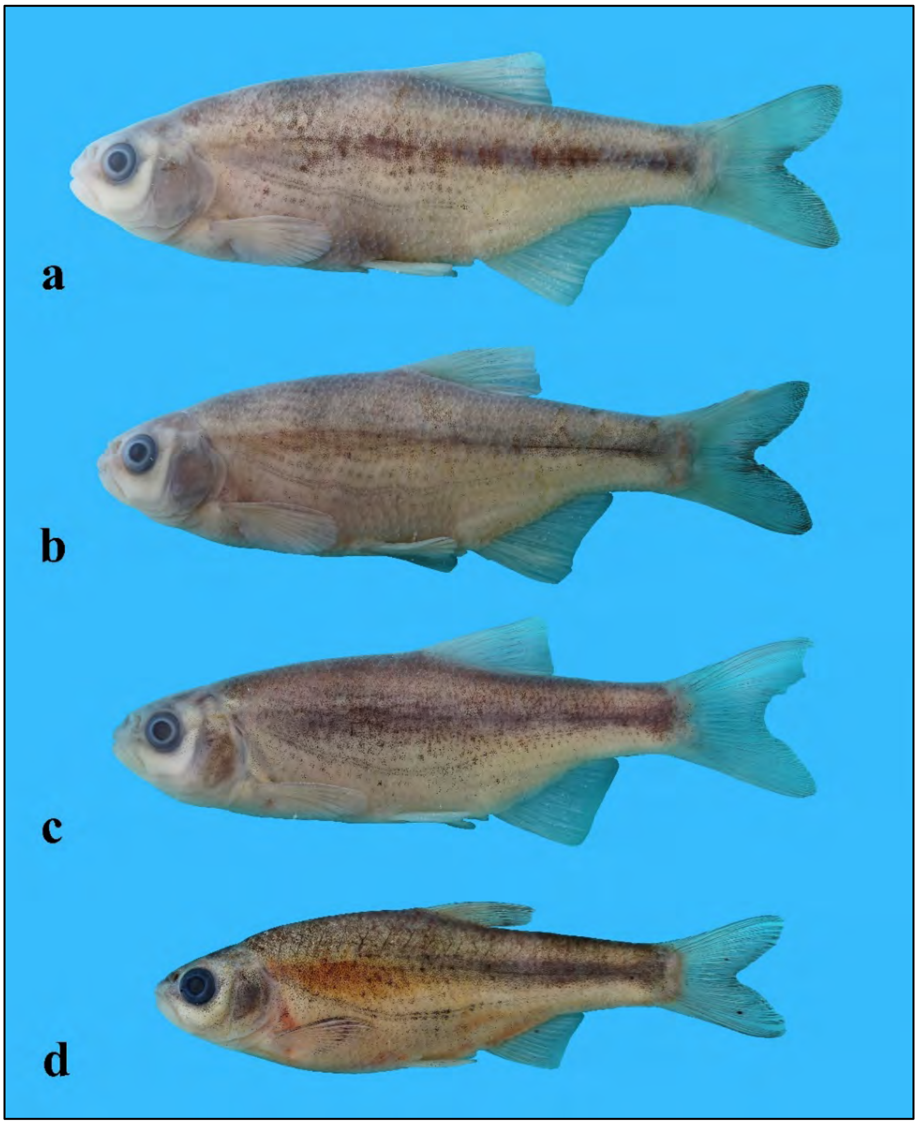
Alburnoides coadi, 84.0 mm standard length, Tehran, Nam River, after Jouladeh Roudbar *et al*. (2016).

Common names. None.

[Coad's riffle minnow, Kavir spirlin].

Systematics. The holotype is under VMFC-ALK2-H (VMFC = Vatandoust and Mousavi-Sabet Fish Collection, Tehran), 107.9 mm standard length, Iran, Tehran Province, Namroud River, Hableroud River drainage, Kavir basin, 35°43′N, 52°39′E. Paratypes are under VMFC-ALK2-P1 to VMFC-ALK2-P45, 45, 55.2-81.4 mm standard length, collected with the holotype and GUIC-ALK2-P1 to GUIC-ALK2- P4 (GUIC = Ichthyological Museum of the University of Gilan), 4, 58.2-66.0 mm standard length, collected with the holotype. The species name *coadi* is in honour of Brian W. Coad (Canadian Museum of Nature, Ottawa).

Alburnoides coadi, holotype, VMFC-ALK2-H, Hamed Mousavi-Sabet.



Alburnoides coadi, paratypes, a, 81.0 mm standard length, VMFC-ALK2-P1, b, 76.0 mm standard length, VMFC-ALK2-P3, c, 71.0 mm standard length, VMFC-ALK2-P4, d, 64.0 mm standard length, VMFC-ALK2-P5, Hamed Mousavi-Sabet.

Jouladeh Roudbar and Eagderi (2017) suggested that this species is a synonym of *A. namaki* based on an analysis using the COI gene (the original description was based on morphology). Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1, COI or CO1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and merged *A. coadi*, *A. damghani* and *A. namaki* into a single putative species. Eagderi *et al*. (2019) using the COI gene to study the phylogeny of Iranian *Alburnoides* found this species to be a synonym of *A. namaki*.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the western Dasht-e Kavir basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species has a deep head with a markedly rounded and stout snout, and a small mouth which is between terminal and subterminal. The eye is of a relatively small size, the orbit diameter larger than the snout length and markedly smaller than the interorbital width. The dorsal and anal fins outer margins are truncate to slightly concave. The caudal fin lobes are rounded and the fin moderately forked. Eagderi *et al*. (2020) gave morphometric data for 16 fish, 6.62-9.67 cm total length.

Dorsal fin branched rays 7-9, usually 8, anal fin branched rays 11-14, commonly 12-13, pectoral fin branched rays 11-15, and pelvic fin branched rays 6-7. Lateral line scales 46-52, scale rows between the lateral line and the dorsal fin origin 9-11, typically 9 or 10, scale rows below lateral line to pelvic fin origin 4-6, usually 4-5, scale rows between the lateral line and the anal fin origin 4-6, usually 5-6, and scales around the caudal peduncle commonly 17-19. A pelvic axillary scale is present, its length about 3-4 scale rows. There is a variably scaled ventral keel, most commonly scaled along about two-thirds of its length, or completely scaled. Total gill rakers number 8-10. Pharyngeal teeth are 2,5-4,2. Total vertebrae 39-41, with a mode of 40, predorsal vertebrae 13-14, abdominal vertebrae 19-20, and caudal vertebrae 19-21. The caudal vertebral region is equal or slightly longer than the abdominal region (vertebral formulae 19+20, 20+20 and 20+21).

Meristic values are:- dorsal fin unbranched rays 3 and branched rays 7(4), 8(47) or 9(1), anal fin rays unbranched 3, anal fin branched rays 11(2), 12(27), 13(19) or 14(4), pectoral fin branched rays 11(8), 12(18), 13(23), 14(2) or 15(1), and pelvic fin branched rays 6(3) or 7(49). Lateral line complete with 0-2 unpored scales at the posterior end of the lateral series. Lateral line scales 46(2), 47(2), 48(18), 49(19), 50(6) or 51(5), scales above lateral line to dorsal fin origin 9(10), 10(40) or 11(4), scales below lateral line to anal fin origin 4(19), 5(24) or 6(9), scales below lateral line to pelvic fin origin 4(29), 5(22) or 6(1), and total scale radii 16(7), 17(10), 18(28) or 19(5). Total gill rakers 8(25), 9(23) or 10(2). Pharyngeal teeth 2,5-4,2(10). Abdominal vertebrae 19(12) or 20(38), caudal vertebrae 19(12), 20(27) or 21(9), predorsal vertebrae 13(37) or 14(13), and total vertebrae 39(15), 40(26) or 41(9).

Sexual dimorphism. The fish from CMNFI 1979-0495 collected on 10 July 1978 has the top and sides of the head with small tubercles, scale margins have 1-5 tubercles over most of the back and flank particularly evident over the anal fin and on the lower caudal peduncle, the pectoral and pelvic unbranched ray bears fine tubercles, and the anal fin has fine tubercles lining the unbranched and branched rays.

Colour. Overall colouration is silvery, with the bases of the pectoral (markedly), pelvic and anal fins (slightly) orange. The back and top of head are light to dark grey, with a pale olive hue. Facial bones and the opercle are silvery. The lower portion of the head and body are pearly

white. The flanks above the lateral line may have a golden hue. Faint yellow spots occur in rows along the flanks in some specimens. Preserved fish are overall tan, darker dorsally with horizontal rows of dark blotches formed by dark pigmentation concentrated on the middle of scales, moderately conspicuous, above the lateral line. The lateral line has some scale pores outlined with dark pigmentation, especially the anteriormost scales but there is generally a lack of well-marked spots or dark pigmentation in the lateral line canal. A narrow dark mid-lateral stripe is present along the lateral septum, more discernible from the vertical through the dorsal fin forwards. There is a faint to strong, broad grey to brown mid-lateral stripe, most evident posteriorly, but sometimes extending to the head. Fins are mostly hyaline, with some black pigmentation lining caudal fin rays.

Size. Reaches 125.5 mm total length.

Distribution. This species is found in the western Dasht-e Kavir basin from the Hableh and Nam (= Namrud) rivers (Mousavi-Sabet *et al*., 2015).

Zoogeography. See under the genus.

Habitat. This species is found only in riverine habitats with a temperature of 19°C, pH 6.0, conductivity 0.45 mS (limited data from one collection), clear water and medium to fast water flow. The stream width was about 3-8 m and maximum depth was up to 1 m, with grassy shores, submergent and encrusting plants, and the stream bed was pebbles, gravel and mud. Other species collected syntopically were the cyprinids *Barbus* sp. (presumably *B. miliaris*), *Capoeta aculeata*, *Capoeta buhsei*, *Carassius auratus*, *Carassius gibelio*, *Squalius cf. orientalis* (presumably *S. namak*), the nemacheilid *Paracobitis malapterura*, and the exotic *Oncorhynchus mykiss* (rainbow trout).

Type locality of *Alburnoides coadi*, Tehran, Nam River, Hamed Mousavi-Sabet.

Age and growth. Mousavi-Sabet *et al*. (2017) examined 40 fish, 52.6-125.5 mm total length, from the Nam River and found a *b* value of 3.12. Eagderi *et al*. (2020) examined 16 fish,

6.62-9.67 cm total length, from the Nam River and found a *b* value of 3.45, positive allometric growth. The condition factor was 1.02-1.36, mean 1.21.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported.

Economic importance. Unknown.

Experimental studies. None.

Conservation. Known only from the type locality and therefore likely to be threatened.

Sources. Mousavi-Sabet *et al*. (2015).

Iranian material:- CMNFI 1979-0239, 2, 57.1-79.3 mm standard length, Tehran, Nam River near Firuz Kuh (35°43'N, 52°40'E); CMNFI 1979-0495, 1, 69.2 mm standard length, Markazi, Nam River west of Firuz Kuh (35°43'N, 52°40'E).

Alburnoides damghani

Jouladeh Roudbar, Eagderi, Esmaeili, Coad and Bogutskaya, 2016

Alburnoides damghani, Semnan, Cheshmeh Ali Damghan, after Jouladeh Roudbar *et al*. (2016).

Alburnoides damghani, Semnan, Cheshmeh Ali Damghan, H. R. Esmaeili.

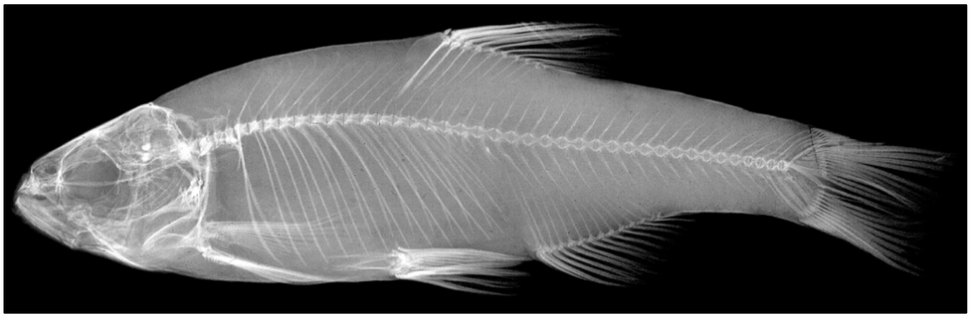
Common names. Mahi-e-Khayateh-e-Damghan (= Damghan tailor fish), lapak or lapek (meaning unknown).

[Damghan riffle minnow, Damghan spirlin, Damghan tailor fish].

Systematics. The holotype is a female, 67.0 mm standard length from Semnan Province, Cheshmeh (= spring) Ali, Damghan River tributary, near Damghan city, Dasht-e Kavir basin, 36º16'45.6"N, 54º05'01.6"E under CMNFI 2015-0091. Paratypes from the same locality are under CMNFI 2015-0091A, 24, 54.6-84.4 mm standard length, ZM-CBSU (Zoological Museum of Shiraz University, Collection of Biology Department, Shiraz) 2011-1, 15, 57.1-79.0 mm standard length and ZM-CBSU 2012-1, 3, 83.9-89.7 mm standard length.

Alburnoides damghani, holotype, CMNFI 2015-0091,
James Maclaine @ Canadian Museum of Nature.

Alburnoides damghani, paratype, CMNFI 2015-0091A,
Bronwyn Jackson @ Canadian Museum of Nature.



Alburnoides damghani, ZM-CBSU 2011-1, paratype with 20+20 vertebral formula,
after Jouladeh Roudar *et al*. (2016).

Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and merged *A. coadi*, *A. damghani* and *A. namaki* into a single putative species. *A. damghani* was still given as valid in the *Catalog of Fishes* (downloaded 31 May 2021) and was described and differentiated in part from DNA evidence too.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in Cheshmeh Ali and adjacent waters of the northern Dasht-e Kavir basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a weakly-developed, variably-scaled, ventral keel from completely scaleless to completely scaled, a stout short snout with tip of the mouth cleft on a level with the lower margin of the pupil or lower, and a small eye (eye horizontal diameter slightly to markedly less than interorbital width). The body is compressed but thick, the upper body profile clearly convex, similar to the lower profile. The caudal peduncle is short and relatively deep. The snout is short and stout, only slightly pointed, its length only slightly exceeds the eye diameter. The mouth is small, terminal, the mouth cleft is slightly curved, and the posterior end of the upper jaw is commonly in front of a vertical with the anterior margin of eye. The upper jaw is slightly produced over the lower jaw in most specimens, especially larger-sized ones. The posterior end of the lower jaw is on a vertical with the anterior margin of the pupil. The caudal fin lobes are rounded and the fin is shallowly forked. The dorsal fin margin is truncate to slightly convex. The anal fin margin is slightly concave. The anal fin origin is on a vertical from the posterior end of the dorsal fin base, or in front of it.

Dorsal fin unbranched rays 4, branched rays 7-9, commonly 8, anal fin unbranched rays 3, branched rays 10-13, commonly 11-12, pectoral rays 13-15, pelvic rays 6-8, total lateral line scales 40-47 (40-46 scales to posterior margin of the hypurals), pharyngeal teeth 2,5-4,2 and 2,5-4,1, total gill rakers 6-8, total vertebrae 39-42, commonly 40, predorsal vertebrae 12-14, commonly 13, and the abdominal vertebral region most commonly equal to or longer than caudal region (vertebral formulae 20+20 and 21+19).

Meristic values are:- dorsal fin unbranched rays 3(35) or 4(4), branched rays 7(5), 8(33) or 9(1), and anal fin unbranched rays 3, branched rays 10(2), 11(11), 12(20) or 13(6). Lateral line scales 40(2), 41(3), 42(7), 43(5), 44(1), 45(3) or 46(1). There is a pelvic axillary scale and scales extend over the proximal bases of the anal fin forming a sheath. The ventral keel (examined in 24 paratypes) is weakly pronounced, scaleless (7), scaleless along three-quarters of keel (4), two-thirds (4), half (5), quarter (2), fifth (1) or completely scaled (1). Total gill rakers number 6(5), 7(16) or 8(3), rakers are short, thick and widely spaced, the longest touching the adjacent one when appressed. Pharyngeal teeth are 2,5-4,2(19) or 2,5-4,1(5). Total vertebrae number 39(4), 40(28) or 41(7), predorsal vertebrae 12(5), 13(26) or 14(8), abdominal vertebrae 20(31) or 21(8) and caudal vertebrae 19(8), 20(28) or 21(4). The vertebral formulae are 20+20(24), 21+19(5), 20+21(4), 20+19(3), 21+20(3), 20+19(1) or 19+20(1). The caudal vertebral region most commonly is equal to the abdominal region (in 23 paratypes) or longer than the latter (11), the difference between abdominal and caudal counts being +2(5), +1(6), 0(23) or -1(5).

Cephalic sensory canals are typical of most *Alburnoides*. The supraorbital canal is not lengthened in its posterior section and has 8-10, commonly 9 pores with 2-4, commonly 3, and 5-7, commonly 6, canal openings on the nasal and frontal bones, respectively. The infraorbital canal has 13-17, commonly 14-15, pores with 4 (rarely 3 or 5) canal openings on the first infraorbital. The preopercular-mandibular canal is complete, with 13-17, modally 14-16, pores

and commonly 5 or 6 and 8 or 9 canal openings on the dentary and preoperculum, respectively. The supratemporal canal is complete, with 5 (rarely 6 or 7) pores.

Sexual dimorphism. In CMNFI 2015-0091A, fish 60.5-84.4 mm standard length caught on 22 August 2011, have mature males bearing tubercles on the unbranched and branched fin rays, in a single row branching into two distally on the branched rays. These are most prominent on the pectoral, pelvic and anal fins. Tubercles line scale margins in a single row of up to six tubercles, in particular over the anal fin and on the lower caudal peduncle. Scales below the dorsal fin are also lined with tubercles but to a much lesser extent than those above the anal fin. Flank scales generally may bear tubercles but many do not and anterior flank scales may have only a single tubercle. Minute tubercles are present on the dorsal and upper head surface.

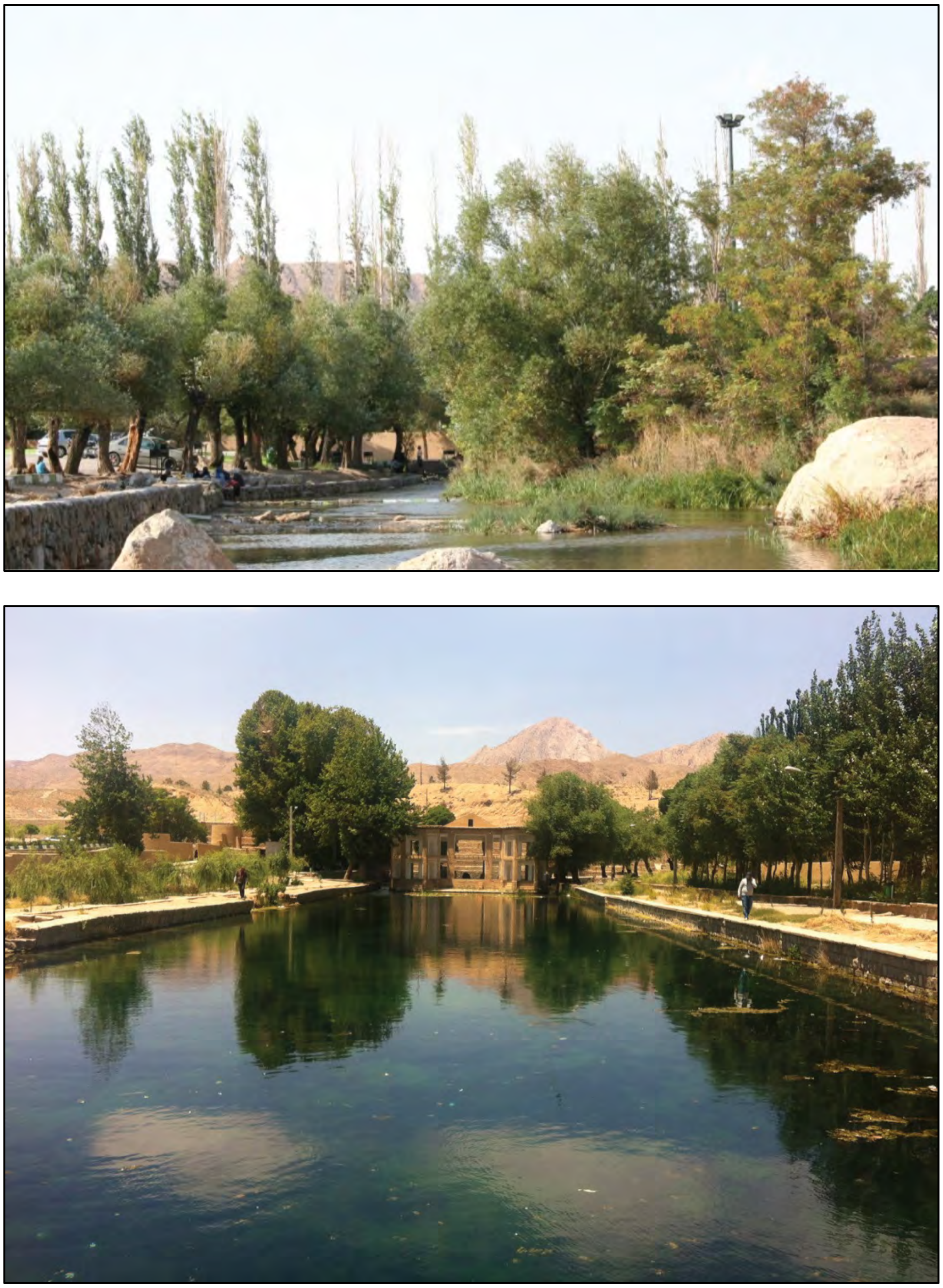
Colour. A darker back fades to a silvery white belly. There are three to four rows of large dark spots above the lateral line starting from the posterior part of the operculum and ending at the posterior level of the anal fin, continuing with two rows behind the anal fin to the base of the caudal fin. A mid-flank stripe is evident, darkest on the caudal peduncle. Small black spots are on the operculum, behind and below the eye, and smaller and less dark spots are between the eye and upper jaw. The lateral line is demarcated by pigment above and below it (the typical stitched pattern in many *Alburnoides* species), the bases of the anal, pelvic, pectoral and dorsal fins are almost reddish-orange, the caudal fin base is pale or faint yellow. The pectoral fin unbranched ray is lined with melanophores on its inner margin. The posterior free margin of the dorsal, anal, caudal and pelvic fins is whitish hyaline, faint pigmentation on the caudal fin centre branches distally to follow the inner margins of the fin fork, and there is fine pigmentation on the proximal part of the dorsal and anal fin rays, darker in the dorsal fin rays**.** The peritoneum is silvery with fine melanophores.

Size. Reaches 89.7 mm standard length.

Distribution. Known principally from the type locality in the Dasht-e Kavir basin, a record below from a qanat at nearby Ebrahimabad is assigned to this species.

Zoogeography. This species is most closely related morphologically to *A. namaki*, *A. varentsovi* and *Alburnoides* sp. from the Amu Darya River. Phylogenetically, based on COI gene sequences, this species is closest to *A. namaki*.

Habitat. This species is found in spring, stream and qanat habitats. The spring type locality was about 5-10 m wide, with substrate consisting of coarse gravel and boulders, good riparian vegetation and almost fast-flowing and transparent waters. The physicochemical parameters at the spot were:- dissolved oxygen 7.54 mg/l, total dissolved solids 318 mg/l, salinity 0.32‰, conductivity 552 μm/cm, pH 7.97 and water temperature 23.25°C. The site is at 1,569 m altitude.



Habitats of *Alburnoides damghani*, Semnan, Cheshmeh Ali Damghan,
after Jouladeh Roudbar *et al*. (2016).

Age and growth. Narjes Tabatabaei *et al*. (2013) found fish from Cheshmeh Ali had age groups 0^+ to 5^+ years and $W = 0.000021TL^{2.92}$. Tabatabaei *et al*. (2015) gave *b* values of 2.9 for Cheshmeh Ali (pooled sexes, 17 females 2.77, 23 males 3.05). von Bertalanffy growth parameters were $L_\infty = 120.0$, $K = 0.29$, $t_0 = -1.0$ and $\Phi = 8.34$. Age classes were 1^+ to 5^+, with the most abundant age class being 3^+ years. Fish in Cheshmeh Ali had a higher condition factor, length and weight, perhaps because of stable conditions and food abundance, or possibly sampling error, compared to fish from the Jaj River and Qareh Chay (a different species). Mousavi-Sabet *et al*. (2017) examined 30 fish, 55.3-89.5 mm total length, from Cheshmeh Ali

and found a *b* value of 3.24. Eagderi *et al*. (2020) examined 45 fish, 7.13-11.07 cm total length, from Cheshmeh Ali and found a *b* value of 3.5, positive allometric growth. The condition factor was 0.77-1.37, mean 1.11.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported.

Economic importance. None.

Experimental studies. None**.**

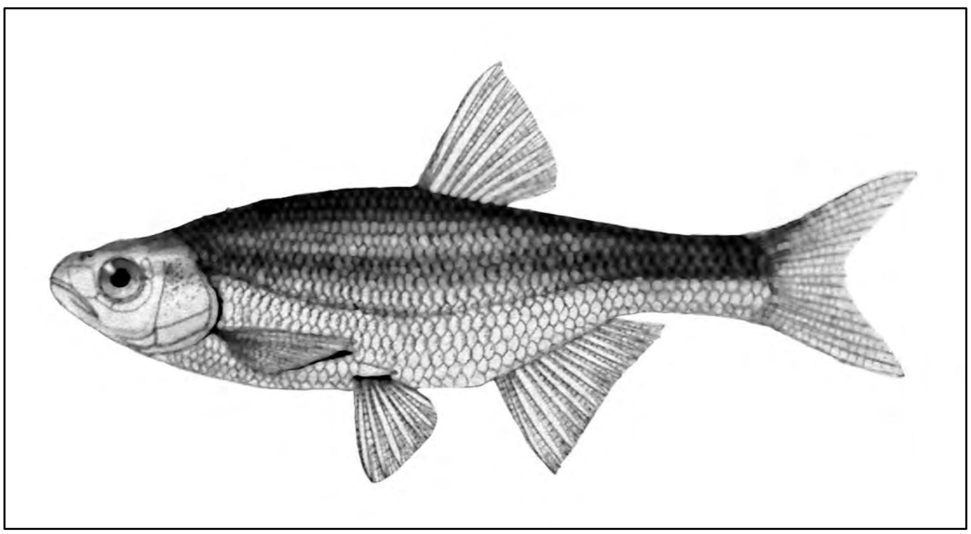
Conservation. Its restricted range, drought in recent years and introduction of the exotic carnivorous *Oncorhynchus mykiss* (rainbow trout) (personal observation of H. R. Esmaeili), may threaten this endemic species. Jouladeh-Roudbar *et al*. (2020) listed it as Critically Endangered for the above reasons.

Sources. Jouladeh Roudbar *et al*. (2016).

Type material:- *Alburnoides damghani* (CMNFI 2015-0091, CMNFI 2015-0091A, ZM-CBSU 2011-1) and ZM-CBSU 2012-1).

Iranian material:- CMNFI 2008-0298, 1, 59.3 mm standard length, Semnan, qanat at Ebrahimabad (36º04'N, 54º14'E).

Alburnoides eichwaldii
(De Filippi, 1863)



Alburnoides eichwaldii, ca. 8.9 cm total length, ZISP 10249, Georgia, Kura River at Borzhomi (= Borjomi), after Berg (1948-1949).

Alburnoides eichwaldii, a, 66.0 mm standard length, b, 68.0 mm standard length, GUIC AL201EI, Ardebil, Balekhlu River, Aras River basin, Hamed Mousavi-Sabet.

Alburnoides eichwaldii, Iran, Hamid Reza Esmaeili.

Alburnoides eichwaldii, Ardabil, Aras River at Parsabad, Hamid Reza Esmaeili.

Alburnoides eichwaldii, Turkey, Ardahan Province, Hanak Stream, Kura River drainage, after Turan *et al*. (2013).

Common names. Khayateh or mahi khayateh (= tailor or tailoress fish, from the lateral line pattern which resembles stitches), khayateh Khazar (= Caspian tailor), kuli (= general term for a small fish), lapak or lapek in Mazandaran (meaning unknown), parak in Gilaki (= scaly since parak is a small feather), sima (= possibly silvery).

[Gijovcu in Azerbaijan; Kura noktalı incise and Noktalı inci balığı in Turkish (Çiçek *et al*., 2020; Kaya *et al*., 2020); Armyanskaya bystryanka or Armenian bystryanka for *A. b. armeniensis*, vostochnaya bystryanka or oriental bystranka, zakavkazskaya bystryanka or Transcaucasian bystranka, all in Russian; Caspian spirlin, Eichwald's riffle minnow, Kura chub, South Caspian spirlin, southwestern Caspian spirlin; riffle bleak or riffle minnow and spirlin in general].

Systematics. This species was long regarded as a subspecies of a wide-ranging European and West Asian species, *Alburnoides bipunctatus* (Bloch, 1782). *Cyprinus bipunctatus* was originally described from the Weser River in Germany. *Alburnus Eichwaldii* De Filippi, 1863, described from the "Kur presso Tiflis" (= Kura River near Tbilisi, Georgia), was regarded as a Caspian Sea basin subspecies of *Alburnoides bipunctatus* but Bănărescu (1991) briefly stated that it could not be distinguished from *Alburnoides bipunctatus fasciatus* (Nordmann, 1840) of the Black Sea basin (the latter now too now recognised as a distinct species, *Catalog of Fishes*, downloaded 27 May 2018). Holčík and Jedlička (1994) considered that the observed variation was clinal and subspecies were not warranted. Reshetnikov *et al*. (1997) also considered subspecies as disputable. There is another nominal subspecies in the Aras River drainage of Armenia, *Alburnoides bipunctatus armeniensis* Dadikyan, 1972, from the rivers Arpa, Vorotan,

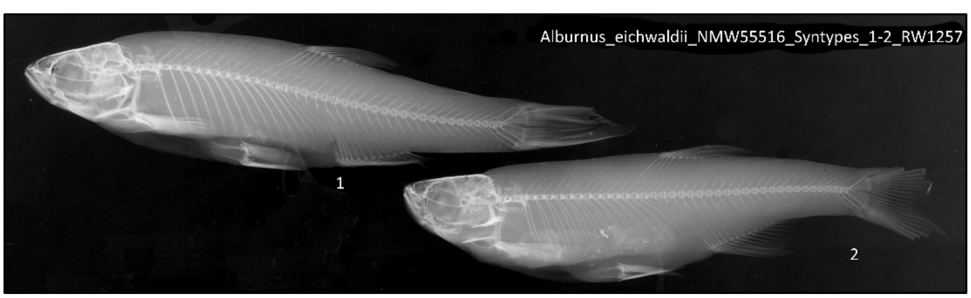
Vedi, Marmarik, Kasakh and their tributaries, now regarded as a synonym of *eichwaldii* (Bogutskaya and Coad, 2009).

Bogutskaya and Coad (2009) resurrected *A. eichwaldii*. Turan *et al*. (2016) and Bektas *et al*. (2019) recorded it from the Aras River basin of Turkey and it also occurs in this basin in Iran.

A syntype of *Cyprinus bipunctatus* described from the Weser River, Germany is in the Museum für Naturkunde, Universität Humboldt, Berlin (ZMB 3357) (Eschmeyer *et al*., 1996).

Two syntypes of *Alburnus eichwaldii* from “Tiflis” are in the Naturhistorisches Museum Wien under NMW 55516 (70.9-74.8 mm standard length) and four syntypes are in the Istituto e Museo di Zoologia della R. Università di Torino under MZUT N.677 (Tortonese, 1940; Eschmeyer *et al*., 1996).

Alburnus eichwaldii, syntypes, NMW 55516, Naturhistorisches Museum, Wien.



Alburnus eichwaldii, syntypes, NMW 55516, Naturhistorisches Museum, Wien.

Syntypes of *Alburnoides bipunctatus armeniensis* are in the Zoological Institute, St. Petersburg under ZISP 37502.

Dadikyan (1973) demonstrated variability in this species in a mountainous region of Armenia within the Aras River basin. Up to 10 characters could be used to distinguish populations within the same river but taken at different altitudes. Populations at similar altitudes but in different rivers (and habitat types, e.g., rushing rocky streams compared to a bog) also varied but the characters were not necessarily the same as those distinguishing altitudinal variants within one river. Local conditions, such as temperature and flow regime, may govern the characters at any one site. Gene flow may play a part as fish are carried downstream by heavy rainfall. Populations living within the same river are presumably more closely related than populations in different river systems but may show more differences than populations at similar altitudes but which have had no gene flow for long periods. These factors could then complicate designation of subspecies in this species and accurate analysis requires large series of specimens.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Aras River basin of northwestern Iran and possibly the western Caspian Sea coast of Iran. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. There are deep-bodied and relatively elongate forms (Berg, 1948-1949). This species is characterised by moderately rounded caudal fin lobes, the caudal fin is not deeply forked, commonly a scaleless ventral keel but may be variably scaled (up to completely scaled), commonly a deep head and slightly to markedly rounded snout, the tip of the mouth cleft is slightly below the level of the middle of the eye or at about the lower margin of pupil, and the upper jaw is slightly protruding over the lower jaw.

Dorsal fin branched rays 6-9, usually 8, anal fin branched rays 10-15, usually 11-13, pectoral branched fin rays 13-15, and pelvic fin branched rays 7. Lateral line scales 44-56 (Dadikyan (1972, 1973) gave 39-56, averaging 48.7, in *A. bipunctatus armeniensis* and Esmaeilipoor Poode *et al*. (2015) gave 40-52 for Iranian Aras River fish). Total gill rakers number 5-12. Pharyngeal teeth are commonly 2,5-4,2 and other variants with four teeth in the longer row of the right ceratobranchial, also, less frequently, 2,5-5,2 or 2,5-5,1. Total vertebrae number 38-43 with a mode of 41, predorsal vertebrae 12-15 with a mode of 14, abdominal vertebrae 18-22 with a mode of 21, and caudal vertebrae 19-22 with a mode of 21. The caudal region is commonly one vertebra shorter than, equal to the abdominal region or one vertebra longer than, the abdominal region, and the difference between the abdominal and caudal numbers varies from +3 to -1 with a mode of 0, and the most common vertebral formulae are 21+21, 21+20 and 20+21. Esmaeilipoor Poode *et al*. (2015) gave 36-41 total vertebrae for Iranian Aras River fish. The syntypes NMW 55516 have 41 and 42 total vertebrae.

Meristic values are:- dorsal fin branched rays 7(14), 8(200) or 9(3), anal fin branched rays 10(4), 11(51), 12(88), 13(60) or 14(14). Abdominal vertebrae 18(1), 19(4), 20(62), 21(134) or 22(14), caudal vertebrae 19(14), 20(86), 21(99) or 22(16), predorsal vertebrae 12(2), 13(82), 14(118) or 15(13), and total vertebrae 38(1), 39(4), 40(26), 41(98), 42(71) or 43(15) (Bogutskaya and Coad, 2009; Mousavi-Sabet *et al*., 2015; material below).

Sexual dimorphism. Abdurakhmanov (1962) reported pelvic fin length greater in males and snout length greater in females for this species in Azerbaijan.

Colour. There is a characteristic pigmentation along the lateral line with a small spot above, and another below, the lateral line opening on each scale. This only appears in preserved material as live fish are an overall silvery colour. It can be absent, mostly in lake forms (Berg,

1948-1949). The flank has a blue-grey stripe wider than the eye diameter. Above the lateral line there may be a series of 5-9 black lines formed of triangular blotches and 3-5 similar lines below the lateral line. The back and head are dark olive, almost black, dark green or dark brown. The flank above the lateral line may have purple iridescent tints. The flanks can be a golden yellow. The belly and lower head are pearly-white. The dorsal and caudal fins have some grey pigment or may be dark grey. The bases of the pectoral, pelvic and anal fins have orange to red pigmentation which is not well-developed in young. The extent and intensity of this pigment is variable between fins, although in some fish it is equally developed on all these fins.

Size. Attains 14.5 cm (Berg, 1948-1949).

Distribution. This species is found in river drainages of the southwestern Caspian coast from the Samur (according to Berg, 1948-1949) down to rivers of the Lenkoran which borders Iran. The Aras River basin also harbours this species. Mainly in the Aras River basin in Iran such as the Aghsu, Ahar, Almas, Aras, Balekhlu-Chay or Balekhlu, Ghotor, Kalibar, Qareh Su, Saghezchai (= Saqqez), Zangbar and Zilber rivers, and the Sattarkhan Dam (Masoumian, 2007; Abdoli and Naderi, 2009; Jafarzadeh *et al*., 2015; Mousavi-Sabet *et al*., 2015, 2017; Jouladeh-Roudbar *et al*., 2016, 2020) but it may occur on the extreme western Caspian Sea coast of Iran as Levin *et al*. (2018) recorded it (with *A. samiii*) in the Lenkoran River of Azerbaijan. This would need testing by DNA for Iranian waters. All *Alburnoides* from the Sefid River basin and west (except the Aras River basin) in Iran are allocated to *A. samiii* in the present work, while recognising some could be *A. eichwaldii*.

Zoogeography. Bektas *et al*. (2019) placed this species, in their analysis of *Alburnoides* in Turkey, in an Eastern Clade and lineage IV, the Caspian Sea basin (and this Clade includes Euphrates species not found in Iran and presumably other species that are). The Eastern Clade split from the Western Clade about 7.7 MYA (the middle Tortonian), coinciding with the existence of the Balkanian-Anatolian-Iranian landmass that continued until the Late Miocene, and diversification occurred during the Late Miocene to middle Pleistocene (Calabrian). Eastern clade groups of species (Ponto-Caspian, Tigris and Euphrates, and Central Anatolia) were separated from 5.98 to 2.37 MYA during the Pliocene uplift of the eastern Anatolian region.

Habitat. This species is found in rivers, streams and dams but commonly inhabits small streams and is less frequent in the main flow of large rivers.

Age and growth. Mousavi-Sabet *et al*. (2017) examined 110 fish, 45.8-123.2 mm total length, from three localities (Aras River, 40 fish, b = 3.18, Saghezchi or Saghezchai (= Saqqez) Stream or River, 30 fish, b = 3.27, and Balekhlu River, 40 fish b = 3.21) with an average b value of 3.03. Eagderi *et al*. (2020) examined 60 fish, 3.98-10.98 cm total length, from the Aras River and found a b value of 3.19, positive allometric growth. The condition factor was 0.82-1.44, mean 1.11.

Cicek *et al*. (2016) examined 162 fish, 3.2-13.0 cm total length, from both rivers and lakes of the Aras River basin in Turkey. They found age groups 0-3 years with 0 and 1 the most frequent. Growth was rapid in the first year and then declined. Length-weight relationships were $W = 0.00644L^{3.2221}$ for rivers and $W = 0.00651L^{3.3714}$ for lakes with b values not significantly different from 3.0 indicating isometric growth. von Bertalanffy growth parameters were L_∞ = 12.91 cm, k = 0.548/year, t_0 = -1.41 year, Φ' = 1.96 and K = 1.08 for rivers and L_∞ = 16.36 cm, k = 0.237/year, t_0 = -2.89 year, Φ' = 1.8 and K = 1.19 for lakes. Instantaneous total (Z), natural (M) and fishing (F) mortalities were 0.88, 0.75 and 0.13/year for rivers and 0.39, 0.37 and 0.02/year for lakes. The exploitation rate (E) was 0.15 and 0.05 for rivers and lakes respectively. Overfishing pressure was absent as these fish were not commercially fished in the Aras River.

In Azerbaijan, maturity was attained at 1-2 years and life span was 3 years (Abdurakhmanov, 1962).

Food. Hajipour *et al*. (2019) examined the diet of fish identified as *A. bipunctatus* (= *A. eichwaldii*) from the Kaleybar (= Kalibar) Chay in the Aras River basin based on 53 fish. The highest and lowest feeding levels were in winter and spring respectively. The species was found to be benthivorous and detritivorous, and no zooplankton were found attributed to the small size (6.7 cm mean length) and low planktonic resources. Infestation with *Ichthyophthirius multifilis* occurred in summer and autumn. Food in Azerbaijan was taken from the bottom or from the water surface, the former being mostly insect larvae and the latter terrestrial organisms which fell on the water. Diatoms were also found in gut contents (Abdurakhmanov, 1962).

Reproduction. Spawning took place in spring (April-June) at 13-15.6°C and adhesive eggs were laid on sand or gravel in fast-flowing water. Fecundity reached 6,496 eggs and egg diameter 2.16 mm in Azerbaijan (Abdurakhmanov, 1962).

Parasites and predators. Fish from CMNFI 2007-0087 carried large black flank blotches, presumably caused by a parasite. Masoumian *et al*. (2005) reported the protozoan parasites *Ichthyophthirius multifilis*, *Trichodina perforata* and *Chilodonella*, sp. from this species (as *A. bipunctatus*) in water bodies in West Azarbayjan. Also, Masoumian (2007) reported the parasites *Diplozoon megan* and *Trichodina perforata* from *Alburnoides bipunctatus* (= *A. eichwaldii*) in the Aras, Ghotor and Zangbar rivers in West Azarbayjan. Mortazavi Tabrizi *et al*. (2005) and Hajirostamloo (2009) recorded *Ligula intestinalis* from fish identified as *A. bipunctatus* in the Sattarkhan Dam in East Azarbayjan. Barzegar *et al*. (2008) recorded the digenean eye parasite *Diplostomum spathaceum* from this fish (as *A. bipunctatus*, possibly *A. eichwaldii* as locality is unclear) from the Saryson River in the western Caspian Sea basin.

Economic importance. None.

Experimental studies. Rahmati-holasoo *et al*. (2014) found that clove oil could be used repeatedly for at least two weeks as an anaesthetic in fish identified as *A. eichwaldii* (locality not given and probably not that species - authors have studied what are now recognised as other *Alburnoides* species). Doustdar *et al*. (2018) found that the highest level of molybdenum contamination in a study of Aras River fish was found in this species (identified as *A. bipunctatus*) at 11.7 µg/g dry weight muscle tissue, as also was arsenic.

Conservation. Kiabi *et al*. (1999), examining Iranian material, considered fish identified as *A bipunctatus* to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included abundant in numbers, habitat destruction, widespread range (75% of water bodies), present in other water bodies in Iran, and present outside the Caspian Sea basin. These assessments may apply, at least in part, to the current taxon as well as other Caspian Sea *Alburnoides*. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Bogutskaya and Coad (2009).

Iranian material:- CMNFI 2007-0086, 2, 35.9-41.2 mm standard length, Ardabil, Qareh Su basin near Nir (ca. 38º02'N, ca. 48º00'E); CMNFI 2007-0087, 2, 74.6-79.2 mm standard length, Ardabil, Qareh Su north of Ardabil (38º22'N, 48º19'E); CMNFI 2007-0089, 2, 36.2-43.7 mm standard length, East Azarbayjan, Ahar Chay at Ahar (38º28'N, 47º03'E); CMNFI 2007-0090, 14, 37.7-48.1 mm standard length, East Azarbayjan, Zilber Chay north of Marand (38º29'N, 45º46'E).

Alburnoides holciki

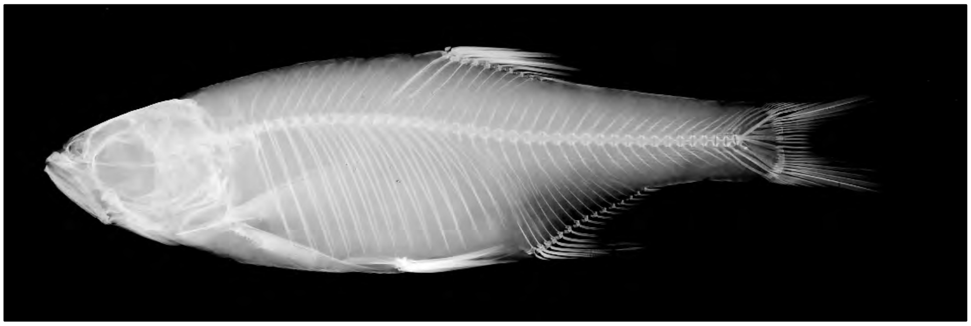
Coad and Bogutskaya, 2012

Alburnoides holciki, a, 64.0 mm standard length, VMFC AL201HO,
b, 58.0 mm standard length, VMFC AL201HO,
Razavi Khorasan, Hari River, Hamed Mousavi-Sabet.

Common names. Kuli-ye Harirud (= Hari River fish), khayateh-e Holčík (= Holčík tailor fish).
[Hari spirlin, Harirud bleak, Holčík's bleak, Holčík's spirlin, Holčík's riffle minnow].

Systematics. The type series consists of SNM-PM 6788, holotype, 80.0 mm standard length, and 18 paratypes, 49.6-92.6 mm standard length, Afghanistan, Hari River at Herat (ca. 34°20'N, 62°12'E). The species was named after the late Juraj Holčík, Bratislava who studied Iranian fishes. Fardanian *et al*. (2016) briefly indicated the species is distinct using cytochrome oxidase 1 sequences. Levin *et al*. (2018) also used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and found this species to be distinct. *Alburnoides parhami* Mousavi-Sabet, Vatandoust and Doadrio, 2015, described from the Atrak River basin, was synonymised with this species by Eagderi *et al*. (2019) using COI gene data and Jouladeh-Roudbar *et al*. (2020) concurred stating there was less than 0.4% genetic distance using their own unpublished COI data.


Alburnoides holciki, holotype, SNM-PM 6788, Brian W. Coad.



Alburnoides holciki, holotype, SNM-PM 6788, Brian W. Coad.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Hari River basin of northeastern Iran. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a well-defined, sharp, scaleless or only slightly scaled, ventral keel, a short, slightly pointed snout, a terminal mouth with the tip of the mouth cleft on a level with the upper half of the pupil, and a large eye (orbit width about equal to interorbital width).

Dorsal fin with 3-4 unbranched and 7-9, usually 8, branched rays, anal fin with 3 unbranched and 10-16, branched rays, usually 14-15, pectoral fin branched rays 13-15, and pelvic fin branched rays 6-8. Lateral line scales 46-55, usually 47-51 (42-57 total lateral line scales), scales between lateral line and dorsal fin origin 9-11, and scales around caudal peduncle 20-26, mostly 20-23. Total gill rakers number 5-9 (Jouladeh-Roudbar *et al*. (2020) gave 6-14), reaching the raker below when appressed, often small and weakly developed, or concealed in the flesh of the gill arch. Pharyngeal teeth are 2,5-4,2, rarely 2,5-5,2. Total vertebrae are 39-42, usually 41, abdominal vertebrae 19-21, caudal vertebrae 19-22, predorsal vertebrae 12-14, usually 13 or 14, and the caudal vertebral region is longer than the abdominal region. The most frequent vertebral formulae are 20+21, 20+22 and 19+21. Levin *et al*. (2019) gave somewhat wider counts for fish from the Amu Darya basin (see below in **Distribution**) and these were incorporated above. The holotype has 41 total vertebrae. Mohammadi-Sarpiri *et al*. (2021) described the osteology of this species. They recorded 35-39 vertebrae including the four Weberian vertebrae, much lower than reported here.

Meristic values are:- dorsal fin branched rays 7(1), 8(46) or 9(7) and anal fin branched rays 10(1), 11(-), 12(1), 13(3), 14(21), 15(23) or 16(5). Abdominal vertebrae 19(9), 20(44) or 21(2), caudal vertebrae 20(5), 21(39) or 22(11), predorsal vertebrae 12(1), 13(38) or 14(15), and total vertebrae 40(5), 41(39) or 42(10) (Coad and Bogutskaya, 2012; Mousavi-Sabet *et al*., 2015).

Sexual dimorphism. Unknown.

Colour. Overall colour in life is silvery with pectoral, pelvic and anal fin bases reddish-orange. Pigmentation in preserved material consists of a darker back and lighter abdomen. A diffuse stripe extends from the head to the tail, being expanded on the tail base, and a dark line separates the hypaxial and epaxial muscle masses and is overlain by the stripe. There are 3-4 rows of spots above the lateral line which may extend back as far as the end of the pelvic fin level. There may be 1-2 rows of spots below the anterior lateral line in front of the pelvic fin level and above the pectoral fin. A stripe occurs before and after the dorsal fin on the back. There is a characteristic pigmentation along the lateral line with a small spot or bar above, and another

below, the lateral line opening on each scale. This also appears in live material even though they are an overall silvery colour. Fins are mostly hyaline with faint pigment along the anterior dorsal fin rays, a line of pigment along the proximal edge of the pectoral fin unbranched ray and weak pigmentation on the first branched ray, and weak pigmentation on the caudal fin centre branching distally to follow the inner margins of the fin fork. The peritoneum is white-grey to light brown overall, the latter from distinct but crowded pale brown spots. Some fish may have a few, very small, black pigment spots on the peritoneum.

Size. Attains 92.6 mm standard length or 94.3 mm total length.

Distribution. This species is found in the Hari River (= Tedzhen) basin, including at Herat, Afghanistan and in Iran from the Hari and Kashaf rivers and the Kardeh and Doosti dams (Abdoli and Naderi, 2009; Coad and Bogutskaya, 2012; Mousavi-Sabet et al., 2018; Jouladeh-Roudbar *et al*., 2020). Levin *et al*. (2019) extended the distribution to the upper Amu Darya basin in Tajikistan (Kafirnigan, Khanaka, Kyzylsu, Tayirsu, Vakhsh and Yakkhsu rivers) and possibly the Zeravshan River basin (Mogian Darya and Zeravshan rivers) in Tajikistan based on morphological and COI barcode data. This species also probably inhabits the Murgab River in Turkmenistan. Also, in the Atrak River basin if *A. parhami* is a synonym. Sheraliev *et al*. (2021) extended the range to inland waters of Uzbekistan.

Zoogeography. Coad and Bogutskaya (2012) gave comparative details with these and other *Alburnoides*.

Habitat. There is no data other than capture in rivers, streams and dams for Iran.

Age and growth. Mousavi-Sabet *et al*. (2017) examined 30 fish, 52.6-93.4 mm total length, from the Hari River and found a *b* value of 3.25. Eagderi *et al*. (2020) examined 27 fish, 6.54-9.43 cm total length, from the Hari River and found a *b* value of 3.29, isometric growth. The condition factor was 0.72-0.93, mean 0.84.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported from Iran.

Economic importance. None.

Experimental studies. None.

Conservation. Jouladeh-Roudbar *et al*. (2020) listed it as Data Deficient as they found it only at the outlet of the Doosti Dam in Iran.

Sources. Type material:- *Alburnoides holciki* (SNM-PM 6788).

Iranian material:- BM(NH) 1914.1.1:30-31, 2, 83.2-92.1 mm standard length, Razavi Khorasan, Kashaf River, Mashhad (ca. 36°18′N, ca. 59°36′E).

Alburnoides idignensis
Bogutskaya and Coad, 2009

Alburnoides idignensis, a, 51.0 mm standard length, b, 55.0 mm standard length, VMFC AL201ID, Kermanshah, Bid-e Sorkh River, Gamasiab River basin, Hamed Mousavi-Sabet.

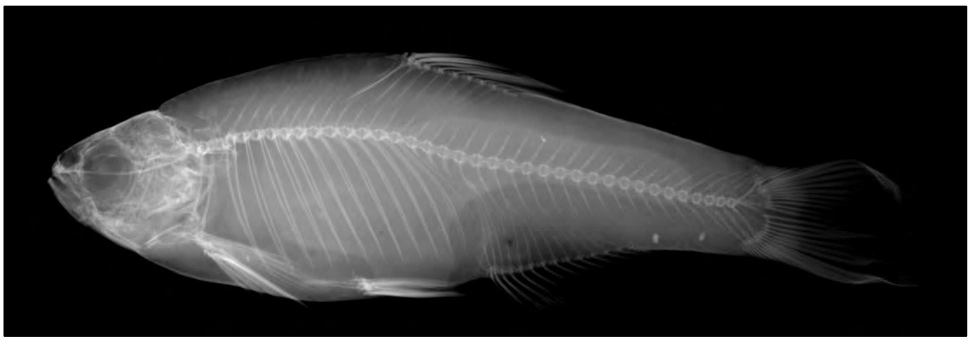
Common names. Khayateh-ye Dejleh or khayateh-e Tigris (both = Tigris tailor fish), lapek or lapak (meaning unknown), shebeh zury (= resembling zury, the latter being an unknown name) in Khuzestan for *Alburnoides* spp.

[Tigris riffle minnow, Tigris spirlin].

Systematics. The holotype (CMNFI 2007-0118) is a male, 89.2 mm standard length, from Kermanshah, Bid Sorkh River between Sahneh and Kangavar, Gamasiab River drainage, ca. 34°23´N, 47°52´E; paratypes (CMNFI 2007-0118A), 13, 33.5-90.0 mm standard length, same data as holotype. The species is named for the Tigris River which was called Idigna in Sumerian (Akkadian: Idiklat; biblical: Hiddekel; Arabic: Dijlah; Turkish: Dicle).

Jouladeh Roudbar *et al*. (2015) were unable to distinguish this species based on 33 morphometric and five meristic characters. Jouladeh Roudbar *et al*. (2016) found this species and *A. nicolausi* were very closely related and not well supported as sister taxa (low posterior probability of 0.62). However, the ancestral node for *A. idignensis* was 1.0, as was the ancestral node for *A. nicolausi*, which is strong support for monophyly of each of these species.

Alburnoides idignensis, holotype, CMNFI 2007-0118,
James Maclaine @ Canadian Museum of Nature.



Alburnoides idignensis, holotype, CMNFI 2007-0118,
Noel Alfonso @ Canadian Museum of Nature.

Levin *et al*. (2018) also used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and found this species not to be distinct from *A. nicolausi*.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Tigris River basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a moderately compressed and relatively thick body, a deep head with a markedly rounded and stout snout, a small mouth which is between terminal and subterminal, a tip of the mouth cleft on a level from the lower margin of the pupil, an eye of average size, an orbit diameter larger than the snout length and markedly smaller than the interorbital width, the junction of the lower jaw and the quadrate on about a vertical through the anterior margin of the pupil, the pectoral fin unbranched ray strongly lined with melanophores on its inner margin, the anal fin origin is in front of a vertical from the posterior end of the dorsal fin base, caudal fin lobes rounded and fin shallowly forked, and a variably scaled ventral keel though most commonly scaled along about one-third to two-thirds of its length.

Dorsal fin branched rays 6-8, commonly 8, anal fin branched rays 9-14, usually 11-12, pectoral fin branched rays 12-16, and pelvic fin branched rays 6-7, usually 7. Total lateral line scales 41-51 (39-49 scales to posterior margin of hypurals), scales above lateral line to dorsal fin origin 8-11, usually 9-10, scales around caudal peduncle 12-18, usually 14-16, pharyngeal teeth commonly 2,5-4,2 or 2,4-4,2, total gill rakers 6-10, total vertebrae 37-40, with a mode of 39, predorsal vertebrae 11-14, abdominal vertebrae 18-20, caudal vertebrae 18-20, a caudal vertebral region most commonly one vertebra shorter or one vertebra longer than the abdominal region,

the most common vertebral formulae are 20+19 and 19+20, and the difference between the abdominal and caudal counts averages 0. The holotype has 38 total vertebrae.

Meristic values are:- dorsal fin branched rays 6(1), 7(19) or 8(78) and anal fin branched rays 9(1), 10(4), 11(54) or 12(35). Abdominal vertebrae 18(1), 19(45) or 20(52), caudal vertebrae 18(1), 19(47) or 20(50), predorsal vertebrae 11(2), 12(71), 13(24) or 14(1), and total vertebrae 37(1), 38(15), 39(63) or 40(19) (Bogutskaya and Coad, 2009; Mousavi-Sabet *et al*., 2015).

Sexual dimorphism. The following characters were significantly different between sexes - greater in females: head width, postorbital distance, and pelvic fin origin to anal fin origin distance; greater in males: head length, pectoral fin length in pectoral fin origin to pelvic fin origin distance, and pelvic fin length in pelvic fin origin to anal fin origin distance. In CMNFI 1979-0278, a fish 52.8 mm standard length caught on 5 July 1977, there are fine tubercles on top of the head and all fins except the caudal fin. The largest tubercles lined the anal fin rays in a single row, branching with branching ray tips. Scales over the anal fin and on the lower caudal peduncle also bore tubercles, up to four lining the scale margin.

Colour. Overall colour is silvery-brown with reddish bases to the pectoral, pelvic and anal fins. The anal fin may have reddish pigmentation on the anterior rays and membranes. The dorsal fin bears dark pigmentation distally. The caudal fin has dark pigmentation lining the fin rays. The head below and behind the eye is silvery. The upper flank scales are mostly light but some are darkly pigmented in no obvious pattern. The lateral line is delineated by some darker pigment above and below but not as strongly as in the *A. petrubanarescui* holotype and obscured by background pigmentation on the caudal peduncle. Some pigment on the flank scales above and below the lateral line give the impression of stripes but this is not strongly developed. A mid-flank stripe is not developed but there is contrasting dark pigment between the yellow stripe. A thin dark or yellow stripe separates the epaxial and hypaxial muscle masses. The back is dark and obscures a predorsal and postdorsal stripe. The fins are mostly immaculate, with some melanophores lining the rays of the dorsal and pectoral fins in particular. The pectoral fin unbranched ray is strongly lined with melanophores on its inner margin. The peritoneum is silvery with fine melanophores and some spots.

Size. Attains 113.4 total length (Mousavi-Sabet *et al*., 2017).

Distribution. This species is from some upper reaches of tributaries of the Karkheh (Qareh Su) River in the Tigris River basin in the Zagros Mountains of Iran. The Karkheh drains into the Tigris just below its confluence with the Euphrates. Assuming this species is the widely-distributed *Alburnoides* of the Tigris River basin in Iran (with *A. nicolausi* very localised), it is found in the Agh Bolagh, Aran, Badavar, Bahmanshir, Bala, Bid Sorkh, Chamzarivar, Chardavol, Cheshmeh Goomle, Cheshmeh Gileh, Dez, Dinorab, Dinvar, Gamasiab, Gaznahle, Gholghol, Haramabad, Jarrahi, Kahman, Karkheh, Karun, Kashkan, Kerend, Kharchang, Khorram (Khorramabad), Kiarud, Malayer, Marun, Marvil, Mereg, Nahr-e Shavor, Qareh Su, Ravand, Ravansar, Sarab Dowrah, Shush, Valam and Zardab rivers, the Aran and Gaznahle streams and the Khondab and Pir Salman wetlands (Jouladeh Roudbar *et al*., 2016, 2020; Taghiyan *et al*., 2016, Keivany and Zamani-Faradonbe, 2017b; Mousavi-Sabet *et al*., 2017; Nasri, 2021).

Zoogeography. See under the genus.

Habitat. This species is found in rivers, streams, wetlands, springs and qanats. This species was captured in the Sarab Dowrah River on 5 July 1977 (CMNFI 1979-0278) at an altitude of 1,370 m, in clear water at 19°C, with pH 6.8, the shore was bushy, some plants were

present in the water, and the river had a stony bed. Other species recorded together with this species were the cyprinids *Alburnus mossulensis* (= *A. sellal*), *Barbus lacerta*, *Capoeta aculeata*, *Cyprinion macrostomus*, *Garra rufa*, the cobitid *Cobitis avicennae*, and the nemacheilids *Oxynoemacheilus kermanshahensis* and *O. kiabii*.

Age and growth. Keivany and Zamani-Faradonbe (2017b) examined 61 fish, 34.8-76.2 mm total length, from the Jarrahi River and found a *b* value of 3.33. Mousavi-Sabet *et al*. (2017) examined 40 fish, 57.9-84.3 mm total length, from the Aran Stream and found a *b* value of 3.36, 33 fish, 73.3-113.4 mm total length, from the Bid Sorkh Stream with a *b* value of 3.22 and 40 fish, 45.5-97.3 mm total length, from the Gaznahle Stream with a *b* value of 3.14, and with an overall *b* value of 3.11. Eagderi *et al*. (2020) examined 37 fish, 4.19-10.21 cm total length, from the Gamasiab River and found a *b* value of 3.13, isometric growth. The condition factor was 1.11-1.78, mean 1.37.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported although fish from CMNFI 2008-0236 were heavily parasitised as evidenced by black spots, possibly encysted trematode larvae.

Economic importance. None.

Experimental studies. None.

Conservation. Jouladeh Roudbar *et al*. (2020) listed it as of Least Concern for its large distribution range, abundance and no known widespread threat, threats being moderate and very local.

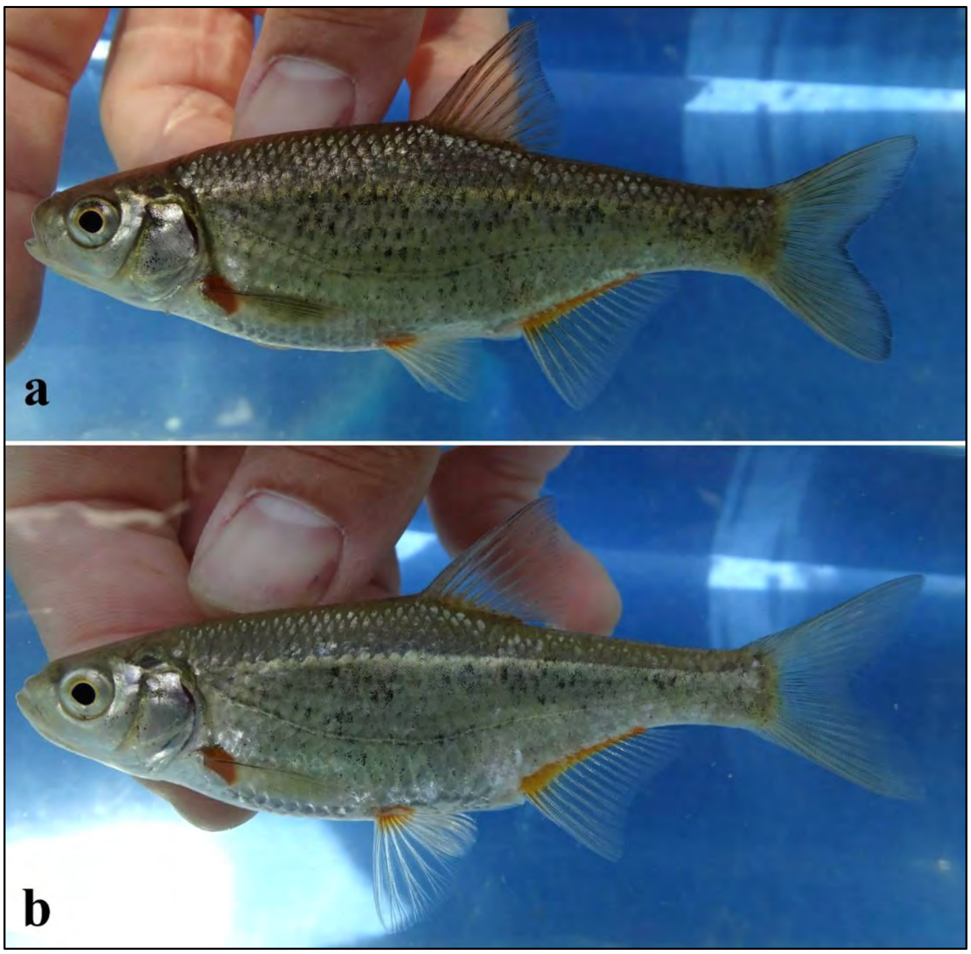
Sources. Type material:- *Alburnoides idignensis* (CMNFI 2007-0118 and CMNFI 2007-0118A).

Iranian material:- CMNFI 1979-0267, 3, 36.1-38.0 mm standard length, Lorestan, river between Nowqan and Khorramabad (no other locality data); CMNFI 1979-0278, 5, 43.3-52.8 mm standard length, Lorestan, Sarab Dowrah River in Kashkan River drainage, 30 km from Khorramabad (33º34'N, 48º01'E); CMNFI 1979-0285, 1, 31.8 mm standard length, Kermanshah, Qareh Su drainage (34º26'N, 46º37'E); CMNFI 1979-0369, 1, 28.1 mm standard length, Khuzestan, Shush River at Shush (32º12'N, 48º14'30"E); CMNFI 2007-0075, 36, 38.1-72.1 mm standard length, Hamadan, Hamadan, Malayer River 5 km from Malayer (ca. 34º17'N, ca. 48º47'E); CMNFI 2007-0112, 2, 31.3-37.4 mm standard length, Kermanshah, Kerend River basin near Shahabad-e Gharb (ca. 34º06'N, ca. 46º30'E); CMNFI 2007-0115, 8, 43.3-62.7 mm standard length, Kermanshah, Qareh Su basin north of Kermanshah (ca. 34º34'N, ca. 46º47'E); CMNFI 2008-0163, 1, 42.2 mm standard length, Khuzestan, Marun River at Chahar Asiab (30º40'28"N, 50º09'34"E); CMNFI 2008-0165, not kept, Khuzestan, Dez River near Shush (32º14'40"N, 48º20'07"E); CMNFI 2008-0175, not kept, Lorestan, Kahman River at Dow Ab-e Aleshtar (33º47'N, 48º12'E); CMNFI 2008-0236, 4, 58.8-83.5 mm standard length, Kermanshah, Mereg River (35º25'N, 46º17'E).

Alburnoides namaki

Bogutskaya and Coad, 2009

Alburnoides namaki, Markazi, Bolagh Spring, Hamid Reza Esmaeili.



Alburnoides namaki, a, 71.0 mm standard length, b, 67.0 mm standard length, VMFC AL201NA, Markazi, Qareh Su (or Qareh Chay) River, Hamed Mousavi-Sabet.

Common names. Khayateh-ye namaki or khayateh-e Namak (= Namak tailor fish), lapak or lapek (meaning unknown).

[Namak riffle minnow, Namak or Namaki spirlin].

Systematics. The holotype, CMNFI 1979-0461, is a female, 91.2 mm standard length

from Hamadan, qanat at Taveh, 35°07´N, 49°02´E. Paratypes are under CMNFI 1979-0461A, 188, 27.2-96.9 mm standard length, same data as the holotype. The species is named for the Namak Lake. Namak means salt in Farsi and the lake itself is fishless but receives numerous freshwater tributaries. Jouladeh Roudbar *et al*. (2015) were unable to distinguish this species based on 33 morphometric and five meristic characters. Jouladeh-Roudbar and Eagderi (2017) found a 0.53% genetic distance in the COI barcode region with *A. coadi* and therefore synonymised the latter.

Alburnoides namaki, holotype, CMNFI 1979-0461,
James Maclaine @ Canadian Museum of Nature.

Alburnoides namaki, paratype, 63.1 mm standard length, CMNFI 1979-0461A,
Bronwyn Jackson @ Canadian Museum of Nature.

Alburnoides namaki, holotype, CMNFI 1979-0461,
Noel Alfonso @ Canadian Museum of Nature.

Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and merged *A. coadi*, *A. damghani* and *A. namaki* into a single putative species, the former two species then being synonyms of *namaki*. Eagderi *et al*. (2019) using the COI gene to study the phylogeny of Iranian *Alburnoides* and also found *A. coadi* to be a synonym.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Namak Lake basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by the lack of strong spots or dark outline to the lateral line canal (however, some specimens have strong pigmentation above and below the lateral line pores, forming an evident pale line margined with dark (Mousavi-Sabet *et al*., 2015)). A broad mid-flank stripe can be well-developed or weakly expressed and, on the caudal peduncle, obscures the lateral line pigment pattern. The lateral line pattern can be weak and this can be seen over the anal fin where the flank stripe does not extend down to the decurved lateral line. The eye is relatively large (27.7-34.5, mean 31.3 in head length), the orbit width about equal to the snout length but markedly smaller than the interorbital width. Caudal fin lobes are rounded and the fin is shallowly forked. There is a sharp, scaleless, ventral keel behind the pelvic fins along the abdomen to the anus. The head is deep with a stout snout which is markedly rounded. The mouth is small, almost subterminal with the tip of the mouth cleft on a level from the lower margin of the eye or below. The junction of the lower jaw and the quadrate is on about a vertical through the middle of the eye.

Dorsal fin branched rays 7-8, usually 8, anal fin branched rays 10-13, usually 11-12, pectoral fin branched rays 12-15, and pelvic fin branched rays 6-7. Lateral line scales 43-52, scales above lateral line to dorsal fin 9-13 (mostly 10-11), and scales around caudal peduncle 14-19 (mostly 16-18). Pharyngeal teeth 2,5-4,2 (or other variants with four teeth on the right ceratobranchial and 1-3 in the minor rows). Total vertebrae 39-41, a low number of predorsal vertebrae at 11-14, commonly 12-13, abdominal vertebrae 19-21, caudal vertebrae 19-21, a caudal vertebral region most commonly equal to the abdominal region, and the most common vertebral formulae are 20+20, 20+19 and 19+20. The holotype has 40 total vertebrae (a fusion counted as two vertebrae).

Meristic values are:- dorsal fin branched rays 7(3) or 8(96) and anal fin branched rays 10(5), 11(36), 12(53) or 13(5). Abdominal vertebrae 19(28), 20(68) or 21(3), caudal vertebrae 19(21), 20(65) or 21(13), predorsal vertebrae 11(3), 12(71), 13(24) or 14(1), and total vertebrae

39(38), 40(57) or 41(4) (Bogutskaya and Coad, 2009; Mousavi-Sabet *et al*., 2015).

Sexual dimorphism. The following characters were significantly different between sexes ($p<0.05$). Head depth, body depth, head width, orbit diameter, and predorsal length were greater in females while pectoral fin length, pelvic fin length, longest dorsal fin ray length, pectoral fin length in pectoral fin origin to pelvic fin origin distance, and pelvic fin length in pelvic fin origin to anal fin origin distance were greater in males.

In a fish from CMNFI 1979-0459, 56.2 mm standard length collected on 9 June 1978, fine tubercles are present on top of the head and larger, but still small tubercles, line the posterior scale margins on the flank, numbering up to six per scale. Tubercles are present on all fins on both unbranched and branched rays, following ray branching. The tubercles are largest and best developed in extent on the anal fin. Other fish may have fine tubercles developed on the side of the head and tubercles on scales are best developed on the caudal peduncle.

Colour. The flanks are a golden-yellow, belly white, back dark green, base of paired and anal fins orange to reddish, and other fins hyaline in life. The lateral line is somewhat darker, above and below, than the surrounding flank but there are no strong spots or dark outline to the canal in the type series. Some pigment on flank scales above and below the lateral line give a faint impression of stripes. A predorsal and postdorsal stripe is present on the back. The fins are mostly immaculate, with some melanophores lining the rays of the dorsal and pectoral fins. Some fish have a series of strong melanophores on the inner margin of the pectoral fin unbranched ray. Dorsal fin membranes may be dusky and lack pigment lining the rays. Caudal fin rays may be quite darkly pigmented, distally clear and the margin dark, or mostly clear. Some paratypes bear strong pigmentation above and below the lateral line pores, forming an evident pale line margined with dark. A broad mid-flank stripe can be well-developed or weakly expressed and, on the caudal peduncle, obscures the lateral line pigment pattern. However, the lateral line pattern can be weak and this can be seen over the anal fin where the flank stripe does not extend down to the decurved lateral line. The pigment on scales above and below the lateral line (and below the mid-flank stripe) can be strongly or weakly expressed and, in the former case, it appears as a series of thin, discontinuous stripes. The peritoneum is silvery with a few melanophores.

Size. Attains 96.9 mm standard length, 110.4 mm total length (Varzani *et al*., 2017).

Distribution. This species is found in the Namak Lake basin of Iran including the Ab-kamar, Bahadorbaik (= Bahador Beyg), Bar, Damagh Tasran, Do Ab, Gazandar, Golushjerd, Jaj, Kaleh, Karaj, Ken, Khamigan, Khenejin, Khomeigan, Kordan, Mazdaqan, Pol-e Doab, Qareh Chay, Qom, Salehabad, Sharra, Siahdareh, Tureh, Yunji and Zehtaran rivers, a qanat at Taveh, and the Latian Dam (Touraji and Vosoughi, 2006; Jazebizadeh and Yekta, 2008; Abbasi *et al*., 2009; Mirzaei *et al*., 2010; Rahmati-holasoo *et al*., 2011; Narjes Tabatabaei *et al*., 2013; Hoghoghi *et al*., 2015; Jouladeh Roudbar *et al*., 2016; Jouladeh Roudbar and Eagderi, 2017; Varzani *et al*., 2017; Tork Haram Abadi *et al*., 2021).

Records from the Nam River (or Namrud) in the Hableh River basin of the Dasht-e Kavir basin were recognised as *A. coadi* (Mousavi-Sabet *et al*., 2015).

Zoogeography. See under the genus.

Habitat. This species is found in rivers, streams, dams, springs and qanats. Hoghoghi *et al*. (2015) examined habitat use in the Jaj River at 18 equally-spaced sites in autumn. They found this species mostly selected the upper parts of the river (1,480-1,490 m of 1,422-1,490 m) with higher slope (1.8-2.0% of 1.2-2.9%), greater depth (35-45 cm of 13-53 cm), lower width (< 10 m of 5-24 m), lower velocity (<1 m/sec of 0.4-1.9 m/sec), a stream bed with bedrock and boulder

cover with bed stone > 40 cm (12-40 cm stones), total dissolved solids 100-150 p.p.m. (of 100-286 p.p.m.), and deciduous and residential riparian types. This species was a good indicator of environmental quality.

Nateghi *et al*. (2017) used several species distribution models to predict future distribution of this species through a correlation between environmental factors and its current “dispersal”. On time scales to the years 2050 and 2080, results showed that in all scenarios this species will have a drastic decrease (100%) from climate change in its potential distribution.

Collection data at the type locality on 10 June 1978 included altitude 1,640 m, water temperature 15.5°C, pH 6.0, conductivity 1.2 mS, qanat stream width 1.5 m, maximum depth 75 cm, vegetation in water encrusting, shore grassy, gravel or mud bottom, medium current, and water clear in parts, others cloudy and polluted, The species was collected with *Capoeta buhsei*.

Habitat of *Alburnoides namaki*, Alborz, Kordan River, Arash Jouladeh-Roudbar.

Age and growth. Narjes Tabatabaei *et al*. (2013) found fish from the Jajrud (= Jaj River) and Qara (= Qareh) Chay had age groups 0^+ to 5^+ years. Condition factor, mean length and weight were higher in Cheshmeh Ali fish (= *A. damghani*, *q.v.*). Jaj River fish had higher growth rate (K and Φ values). Length-weight relationships were $W = 0.000005TL^{3.22}$ for the Jaj River and $W = 0.000009TL^{3.03}$ for the Qareh Chay. Tabatabaei *et al*. (2015) gave *b* values of 3.22 for the Jaj River (pooled sexes, 21 females 3.26, 50 males 3.2) and 3.05 for the Qareh Chay (pooled sexes, 68 females 2.87, 76 males 3.05). von Bertalanffy growth parameters were L_∞ = 112.66 (123.01 in text, presumably an error) and 122.43, K = 0.54 and 0.27, t_0 = 0.18 and - (*sic*), and Φ = 8.83 and 8.31, respectively. Age classes were both 0^+ to 3^+, with the most abundant age classes being 0^+ and 1^+ years, respectively. The overall growth performance was higher in the Jaj River and asymptotic length (L_∞) was smaller. Differences were attributed to the Jaj River fish being downstream from a dam with resulting drought and flood conditions such that higher growth rates reaching sexual maturity and maximum length insured this population’s persistence. Fish in

Cheshmeh Ali (= *A. damghani*, *q.v.*) had a higher condition factor, length and weight, perhaps because of stable conditions and food abundance, or possibly sampling error. Mousavi-Sabet *et al*. (2017) examined 30 fish, 37.5-77.1 mm total length, from the Qareh Chai River (= Qareh Chay) and found a *b* value of 3.19. Varzani *et al*. (2017) studied 259 specimens from the Qareh Chay and Mazlaqan Chai (= Mazdaqan Chay) rivers and found ages of 1-4 years, a male:female sex ratio of 1:1.49, significantly different from a 1:1 ratio, and a higher instantaneous growth rate in immature 1-year age group fish. Eagderi *et al*. (2020) examined 30 fish, 5.23-9.86 cm total length, from the Qareh Chay and found a *b* value of 2.87, isometric growth. The condition factor was 0.87-1.09, mean 0.98. Tork Haram Abadi *et al*. (2021) sampled 325 specimens in the winter of 2018. Male to female sex ratios in the populations studied showed there were no significant differences between males and females in three studied areas. The length-weight relationship in the population from the Golushjerd River was $W = 0.0097TL^{3.15}$, in the Tureh River was $W = 0.0062TL^{3.25}$ and in the Yunji River was $W = 0.0138TL^{2.98}$. Growth patterns of the Golushjerd and Tureh rivers were positive allometric and of the Yunji River was isometric. The condition factor between ages showed, that for both males and females, the highest value was observed for all ages in the Yunji River. The highest value of this coefficient was observed for males in the Golushjerd River and the Yunji River at the age of 4^+ and in the Tureh River at 1^+ and 5^+. Maximum growth rate in the Golushjerd and Yunji rivers for both males and females was at the age of 2^+ to 3^+ years and in the Tureh River at 1^+ to 2^+ years. The von Bertalanffy growth model for the Golushjerd River population was $L_t = 172.10(1\text{-}e^{-0.10(t+1.70)}$, for the Tureh River population was $L_t = 193.30(1\text{-}e^{-0.07(t+2.47)}$. and for the Yunji River population was $L_t = 171.95(1\text{-}e^{-0.09(t+2.39)}$.

Food. Unknown.

Reproduction. Varzani *et al*. (2017), for their Qareh Chay and Mazdaqan Chay fish, found a fecundity range of 331-7,060 eggs with an average of 1,591 eggs.

Parasites and predators. Rahmati-holasoo *et al*. (2011) recorded plerocercoids of the cestode *Ligula intestinalis* from fish in the Latian Dam and described the histopathology.

Economic importance. None.

Experimental studies. None.

Conservation. The type locality dried up about 25 years ago (Jouladeh-Roudbar *et al*., 2015). However, Jouladeh-Roudbar *et al*. (2020) listed it as of Least Concern because of its wide distribution and relatively high numbers in two basins(one basin if *A. coadi* is distinct) although the species has been vulnerable to drought in recent years.

Sources. Type material:- *Alburnoides namaki* (CMNFI 1979-0461 and CMNFI 1979-0461A).

Iranian material:- CMNFI 1979-0254, 1, 63.8 mm standard length, Markazi, qanat at Shahabiyeh (ca. 33°52'N, ca. 50°24'E); CMNFI 1979-0255, 4, 40.6-50.9 mm standard length, Markazi, Bar River drainage 2 km west of Shahabiyeh (33º51'30"N, 50º23'E); CMNFI 1979-0459, 2, 25.1-56.2 mm standard length, Hamadan, stream 2 km south of Razan (35º22'N, 49º02'E); CMNFI 1979-0462, 1, 39.8 mm standard length, Markazi, Mazdaqan River (35º06'30"N, 49º40'30"E); CMNFI 1980-0156, 5, 34.1-50.6 mm standard length, Alborz, Karaj River below village (35º47'N, 50º58'E); CMNFI 1993-0154, 1, 79.4 mm standard length, Markazi, Sharra River near Far (34º03'N, 49º20'E); CMNFI 1993-0155, 1, 80.6 mm standard length, Markazi, Sharra River near Khosbijan (34º07'N, 49º23'E); CMNFI 2007-0074, 4, 33.1-41.8 mm standard length, Markazi, Qareh Chay 32 km west of Arak (34°03´N, 49°21´E); CMNFI 2007-0121, 3, 28.0-74.8 mm standard length, Hamadan, stream in Qareh Chay basin

north of Razan (ca. 35°25´N, 49°02´E); CMNFI 2008-0152, 1, 67.8 mm standard length, Namak Lake basin (no other locality data).

Alburnoides nicolausi
Bogutskaya and Coad, 2009

Alburnoides nicolausi, Lorestan, Nurabad Stream, after Jouladeh-Roudbar *et al*. (2020).

Alburnoides nicolausi, a, 67.0 mm standard length, b, 46.0 mm standard length, VMFC AL201NI, Lorestan, Nurabad Stream, by Arash Jouladeh-Roudbar, after Mousavi-Sabet *et al*. (2015).

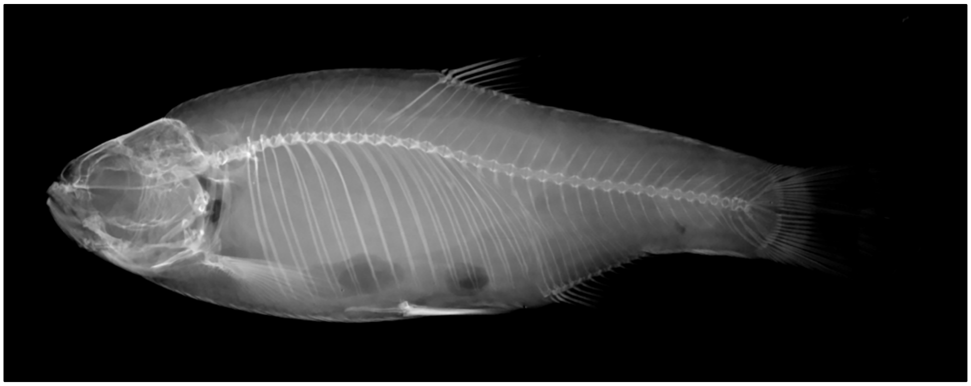
Common names. Khayateh-ye Karkheh (= Karkheh tailor fish), khayateh-e Nicolaus (= Nicholas or Nikolai tailor fish), ghabghaboo (= dewlap or double chin, although relevance unclear), lapak or lapek (meaning unknown), shebeh zury (= resembling zury, the latter being an unknown name) in Khuzestan.

[Karkheh spirlin, Nicholas' riffle minnow, Nicholas' spirlin, Simareh spirlin].

Systematics. The holotype (CMNFI 1979-0281) is a female, 75.0 mm standard length, Lorestan, stream in Simareh River drainage, 5 km south of Nurabad (34°03´30´´N, 47°58´30´´E) and paratypes (CMNFI 1979-0281A) comprise 164 specimens, 21.3-65.0 mm standard length, same data as the holotype. The species is named after a Latin male name Nicolaus, a derivative of the Greek Nikolaos (victory of the people); a Russian name Nikolay and an English name Nicholas, the names of, respectively, Nina Bogutskaya's elder son and Brian W. Coad's son, are also derivatives from Nicolaus.

Alburnoides nicolausi, holotype, CMNFI 1979-0281,
James Maclaine @ Canadian Museum of Nature.

Alburnoides nicolausi, paratype, CMNFI 1979-0281A,
Bronwyn Jackson @ Canadian Museum of Nature.



Alburnoides nicolausi, holotype, CMNFI 1979-0281,
Noel Alfonso @ Canadian Museum of Nature.

Jouladeh Roudbar *et al*. (2015) were unable to distinguish this species based on 33 morphometric and five meristic characters. Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and found this species not to be distinct from *A. idignensis*. Eagderi *et al*. (2019) used the COI gene to elucidate the phylogeny of Iranian *Alburnoides* and grouped *A. nicolausi* in an *A. idignensis* complex, not the same as synonymising the species. Jouladeh-Roudbar *et al*. (2020) recognised both this species and *A. idignensis* as valid but presented no arguments. However, the low dorsal fin branched ray count of 7 (91.3%) is unusual in Iranian *Alburnoides*. The (few) specimens of *A. nicolausi* and *A. idignensis* analysed fall into two distinct groups that are congruent with the current taxonomy. They are very closely related. More molecular sequence data are needed, especially nuclear, to add to the mitochondrial data. No conclusions about synonymy, or taxonomy broadly, should be made based upon the limited molecular data presented. Eagderi *et al*. (2021) showed that this species is well-separated morphometrically from other Iranian *Alburnoides* species.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Nurabad Stream or River of the Tigris River basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. The body is moderately compressed and relatively thick. The upper body profile is convex similar to the lower profile. The head is deep. The snout is only slightly rounded, almost pointed. The mouth is oblique, slightly below than terminal, and the tip of the mouth cleft is slightly below a level of the lower margin of the pupil. The junction of the lower jaw and the quadrate is on about a vertical through the middle of the eye. The anal fin origin is somewhat behind a vertical from the posterior end of the dorsal fin base. The eye is of average size, the orbit diameter larger than the snout length and smaller than the interorbital width, caudal fin lobes are rounded and the fin is shallowly forked.

Dorsal fin branched rays 7-8, usually 7, anal fin branched rays 8-11, pectoral fin branched rays 11-14, and pelvic fin branched rays 6-7. Lateral line scales 42-50, scales between lateral line and dorsal fin origin 8-11, often 9-10, and scales around caudal peduncle 13-17, usually 14-16. A ventral keel between the pelvic and the anal fins is not sharp and is variably scaled: completely scaleless (9), scaled along about one-quarter to one-third of its length (9), scaled along half of its length (6), scaled along about two-thirds of its length (4) or completely scaled (2). There is a pelvic axillary scale and scales extend over the proximal bases of the anal fin forming a sheath. Total gill rakers number 5-9. Pharyngeal teeth are commonly 2,5-4,2 or

2,4-4,2. Total vertebrae number 38-40. The holotype has 38 total vertebrae.

Meristic values are:- dorsal fin branched rays 7(73) or 8(7) and anal fin branched rays 8(2), 9(12), 10(47) or 11(19). Abdominal vertebrae 19(23), 20(53) or 21(4), caudal vertebrae 18(15), 19(41) or 20(24), predorsal vertebrae 12(34) or 13(46), and total vertebrae 38(19), 39(53) or 40(8) (Bogutskaya and Coad, 2009; Mousavi-Sabet *et al*., 2015).

Sexual dimorphism. The following characters were larger in females:- pectoral fin origin to pelvic fin origin distance, pelvic fin origin to anal fin origin distance, prepelvic fin length, and mouth width. The following were larger in males:- caudal peduncle length, pectoral fin length, pelvic fin length, longest dorsal fin ray length, longest anal fin ray length, pectoral fin length in pectoral fin origin to pelvic fin origin distance, and pelvic fin length in pelvic fin origin to anal fin origin distance.

Colour. Overall colour is light brown to silvery with the lower flank and belly quite pale. A few large flank blotches may be present, above and below the lateral line. The back is dark but predorsal and postdorsal stripes are evident. The lateral line is delineated by some darker pigment above and below but not as strongly as in the *A. petrubanarescui* holotype and obscured by background pigmentation on the caudal peduncle. Some fish almost entirely lack lateral line pigmentation while in others it is strongly developed. The pigment on scales above and below the lateral line (and below the mid-flank stripe) can be obvious and form a series of thin, discontinuous stripes, or it can be absent. The mid-flank stripe is weak and diffuse, fading anteriorly under the dorsal fin. The fins are mostly immaculate, with some melanophores lining rays of the dorsal and pectoral fins in particular. A thin line of yellow pigment can be evident separating the hypaxial and epaxial muscle masses, fading anteriorly or extending from head to tail. The pectoral fin unbranched ray is lined with melanophores on its inner margin, but not as strongly as in some other samples. Dorsal and anal fins can be quite heavily pigmented. The peritoneum is silvery with fine melanophores and some spots.

Size. Reaches 75.0 mm standard length, 88.0 mm total length (Rezamand *et al*., 2018).

Distribution. The species is known from its type locality, a stream in the Simareh River drainage at Nurabad, Iran (Nurabad Stream after Mousavi-Sabet *et al*. (2017) and Norabad River after Jouladeh-Roudbar *et al*. (2020)). The Simareh (Seymareh) flows into the Karkheh (Qareh Su) River which enters the Hawr al Hawizeh (Hawr al Azim) on the Iran-Iraq border (Tigris River drainage). Nowferesti *et al*. (2014) reported it from Aligudarz, Lorestan presumably in the Aligudarz River, and Rezamand *et al*. (2016, 2018) reported it from the Huzian River, Lorestan although Jouladeh-Roudbar *et al*. (2020) regarded other identifications of this species outside the type locality as mis-identifications for *A. idignensis*.

Zoogeography. In tree diagrams (Bogutskaya and Coad, 2009) based on combined data, this species clustered together with another Tigris River basin species, *A. idignensis*.

Habitat. Habitat data is based on collection data in the type description. Fish were collected on 6 July 1977 at 2,000 m altitude, 19°C water temperature, clear water, pH 6.8, forested shore, stony river bed, moderate amounts of aquatic plants, and no other species taken.

Age and growth. Nowferesti *et al*. (2014) found a *b* value of 3.28 for 11 fish, 4.6-6.9 cm total length, from Aligudarz, Lorestan. Rezamand *et al*. (2016) found *b* values of 3.251-3.498 for fish from the Huzian River, Lorestan and later Rezamand *et al*. (2018) gave values of 3.494 for 28 females, 4.4-7.5 cm total length and 3.405 for 43 males, 3.9-8.8 cm total length from the same river. All the preceding may refer to *A. idignensis*. Mousavi-Sabet *et al*. (2017) examined 30 fish, 43.1-78.6 mm total length, from the Nurabad Stream and found a *b* value of 2.94.

Food. Unknown.

Reproduction. Unknown.
Parasites and predators. None reported.
Economic importance. None.
Experimental studies. None.
Conservation. Jouladeh-Roudbar *et al*. (2020) listed it as Critically Endangered because of its restricted distribution, unregulated exploitation of water resources for agriculture and seasonal use of pesticides on neighbouring fields.
Sources. Type material:- *Alburnoides nicolausi* (CMNFI 1979-0281 and CMNFI 1979-0281A).

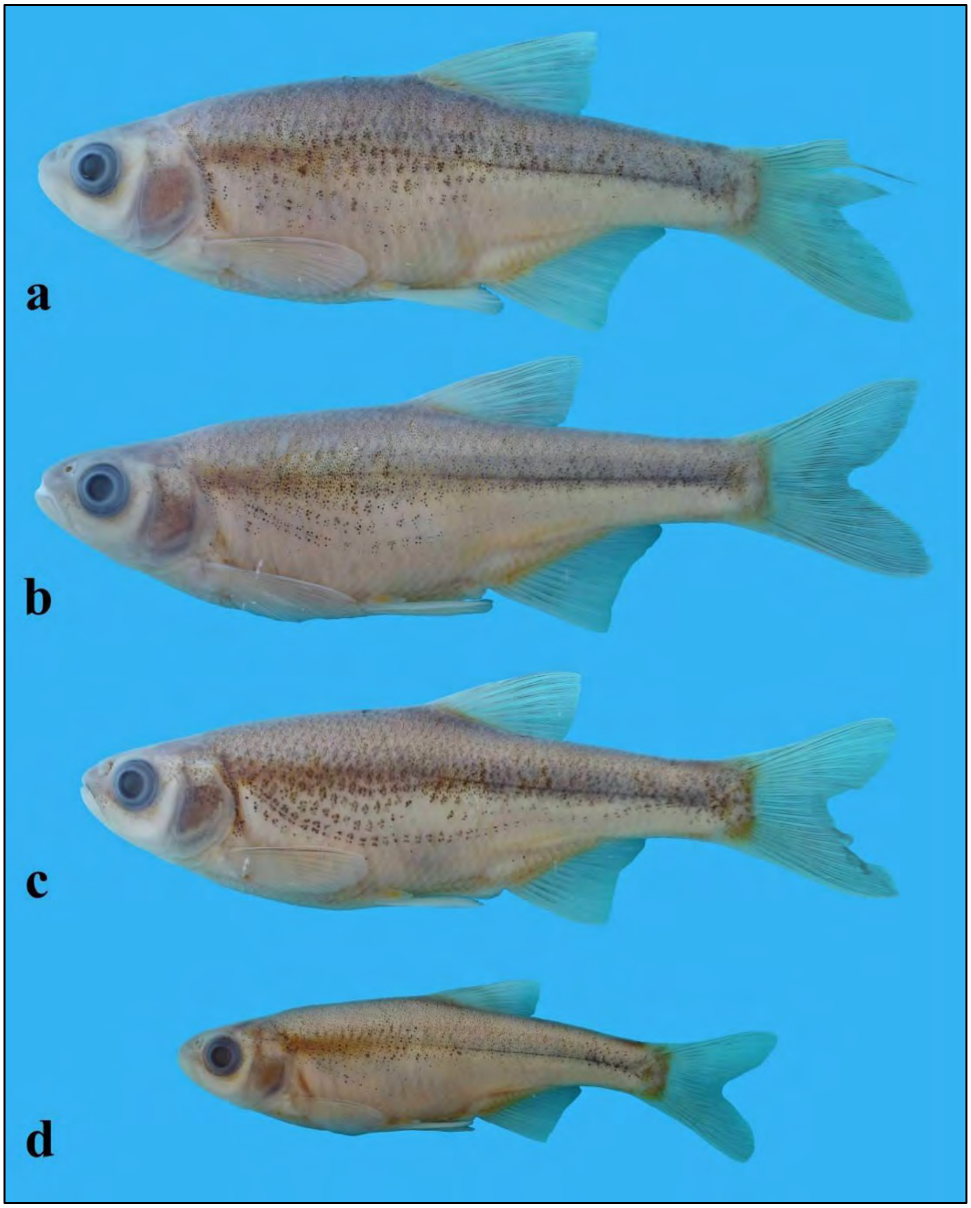
Alburnoides parhami
Mousavi-Sabet, Vatandoust and Doadrio, 2015

Alburnoides parhami, North Khorasan, Atrak River at Baba Aman, Hamid Reza Esmaeili.

Common names. None.
[Atrak spirlin, Parham riffle minnow].
Systematics. The holotype is under VMFC-ALP3-H (VMFC = Vatandoust and Mousavi-Sabet Fish Collection, Tehran), 66.5 mm standard length, Iran, Khorasan-e-Shomali (= North Khorasan) Province, Baba-Aman Stream, Atrak River drainage, the southeastern Caspian Sea basin, 37°29'N, 57°26'E. Paratypes are under VMFC-ALP3-P1 to VMFC-ALP3-P45, 45, 39.9-62.0 mm standard length, and GUIC-ALP3-P1 to GUIC -ALP3-P4 (GUIC = Ichthyological Museum of the University of Gilan), 4, 43.1-53.5 mm standard length, collected with the holotype. The species name *parhami* is generally in honour of all the Iranian conservation officers who sacrificed their lives in order to keep the wild environment, and especially for Mr. Saeid Parham (1980-2009), the conservation officer in North Khorasan Province, who was killed in a battle with illegal hunters near the type locality of *Alburnoides parhami* (near the border of Turkmenistan).

Alburnoides parhami, a, holotype, VMFC-ALP3-H,
b, paratype VMFC-ALP3-P7, 60.0 mm standard length, Hamed Mousavi-Sabet.

Alburnoides parhami, holotype, VMFC-ALP3-H, Hamed Mousavi-Sabet.



Alburnoides parhami, paratypes, a**,** 62.0 mm standard length, VMFC-ALP3-P1, b**,** 61.0 mm standard length, VMFC-ALP3-P2, c**,** 56.0 mm standard length, VMFC-ALP3-P3, d**,** 41.0 mm standard length, VMFC-ALP3-P5, Hamed Mousavi-Sabet.

Jouladeh-Roudbar and Eagderi (2019) examined 21 morphometric and 8 meristic characters as well as the COI gene of *A. parhami* and *A. holciki*, its closest relative, and concluded the former was a synonym of the latter. Esmaeili and Abbasi(2021) recognised this species as valid in their recent checklist and Pourshabanan *et al.* (2021) using cytochrome *b* also regarded the species as valid.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Atrak River basin of the eastern Caspian Sea. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by most commonly a sharp, scaleless ventral keel, a long, slightly pointed snout, a terminal mouth with the tip of the mouth cleft on a level

with the upper half of the pupil, the lack of well-marked spots or dark pigmentation in the lateral line canal, a large eye (orbit width about equal to interorbital width), lateral line scales 46-52, pharyngeal teeth commonly 2,5-5,2, dorsal fin branched rays usually 8, anal fin branched rays commonly 11-13, scale rows between lateral line and dorsal fin origin typically 10, total vertebrae 39-41, usually 40-41, caudal vertebral region equal or slightly longer than abdominal region (most frequent vertebral formulae 20+20 and 20+21), and predorsal vertebrae 12-13.

Meristic values are:- dorsal fin unbranched rays 3, branched rays 7(2), 8(47) or 9(1), anal fin unbranched rays 3, branched rays 11(4), 12(26), 13(24), 14(4) or 15(2), pectoral fin branched rays 11(18), 12(24), 13(7) or 14(1), and pelvic fin branched rays 6(6) or 7(44). Lateral line complete with 0-2 unpored scales at posterior end. Lateral line scales 46(1), 47(4), 48(23), 49(12), 50(5), 51(4) or 52(1), scales above lateral line to dorsal fin origin 8(1), 9(8), 10(39) or 11(2), scales below lateral line to anal fin origin 3(1), 4(47) or 5(2), and scales below lateral line to pelvic fin origin 3(3), 4(45) or 5(2). Total scale radii 16(7), 17(26), 18(14) or 19(3). Total gill rakers 6(2), 7(18), 8(27) or 9(3). Pharyngeal teeth are 2,5-5,2(8) or 2,5-4,2(2). Abdominal vertebrae number 19(1), 20(57) or 21(2), caudal vertebrae 19(2), 20(42) or 21(16), predorsal vertebrae 12(41) or 13(19), and total vertebrae 39(3), 40(42) or 41(15) (Coad and Bogutskaya, 2012; Mousavi-Sabet *et al*., 2015).

Sexual dimorphism. Unknown.

Colour. Overall colouration is silvery, darker on the upper flank. Facial bones and the opercle are silvery. The dorsal and anterior margins of the opercle are yellow to orange. The posterior margin of the operculum is black and there is a black bar behind the operculum on the flank ending ventrally at the reddish anterior pectoral fin base. The bases of the pectoral, pelvic and anal fins and adjacent body are orange. The pectoral fin base may be redder than orange. The anal fin pigment is distally more extensive anteriorly on the fin rays and is at the base for most of the fin. In some fish there is an orange pigmentation at the fin base and an overall yellowish tinge to the fin. The caudal fin can have a yellowish tinge with a clear margin to the fin. The back and top of the head are light to dark grey, with an olive hue. The lower portion of the head and body are pearly-white. The upper margin of the pupil is yellow to orange. The flanks above the lateral line may have a golden or yellowish hue. Faint yellow spots occur in rows along the flanks. Rows of dark blotches are found along scale rows, formed by dark pigmentation concentrated on the centre of scales, more conspicuous above the lateral line and present only as scattered dark pigmentation below it. A diffuse, relatively narrow, dark stripe is present on the caudal peduncle. The lateral line is outlined by dark pigmentation, forming a weakly developed, often interrupted, but conspicuous longitudinal dark stripe. Dorsal and caudal fins have either some grey pigmentation or are dark grey. Pigmentation of preserved specimens is overall tan, darker dorsally. Horizontal rows of dark blotches formed by dark pigmentation are concentrated on the middle of scales, moderately conspicuous, above the lateral line. The lateral line has some scales with pores outlined with dark pigmentation, especially the most anterior scales. A narrow, dark mid-lateral stripe is present along the lateral septum, more discernible from a vertical through the dorsal fin forwards. Fins are mostly hyaline, with some black pigmentation lining the dorsal and caudal fins rays, the dorsalmost pectoral fin rays and the most anterior anal fin rays.

Size. Reaches 83.2 mm standard length.

Distribution. This species is known from the Caspian Sea basin where it is recorded from the Tabarak Dam and the Atrak River and Baba-Aman Stream in the Atrak River basin (Jouladeh Roudbar *et al*., 2016; Mousavi-Sabet *et al*., 2017).

Zoogeography. See under the genus.

Habitat. This species is found in rivers, streams and dams. The Baba-Aman Stream at the type locality had none-clear water, water flow was medium to fast, the stream width was about 3-5 m and maximum depth was up to 1.5 m, with grassy and bushy shores, submergent and emergent plants, and the stream bed was gravel and mud. Other species collected syntopically were *Capoeta gracilis* (= *C. razii*), *Luciobarbus mursa* and *Paracobitis atrakensis*. This species has been collected in one sample at 24°C, pH 6.0, conductivity 1.85 mS, river width 1-6 m, depth 20 cm, pebble and mud bottom, encrusting vegetation and a grassy shore.

Type locality of *Alburnoides parhami*, North Khorasan, Baba-Aman Stream, Atrak River basin, Hamed Mousavi-Sabet.

Age and growth. Mousavi-Sabet *et al*. (2017) examined 30 fish, 50.7-80.1 mm total length, from the Atrak River and found a *b* value of 3.37. Eagderi *et al*. (2020) examined 43 fish, 3.4-7.7 cm total length, from the Atrak River basin and found a *b* value of 3.07, isometric growth. The condition factor was 0.75-1.09, mean 0.93.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported.

Economic importance. None.

Experimental studies. None.

Conservation. Confined to a single river basin in an arid region so threats are likely.

Sources. Mousavi-Sabet *et al*. (2015).

Iranian material:- CMNFI 1979-0486, 1, 27.8 mm standard length, Golestan, stream in Atrak River drainage (37°44'N, 56°18'E); CMNFI 2016-0050, 25, 57.4-83.2 mm standard length, Razavi Khorasan, Tabarak Dam on the Atrak River (37°10'24"N, 58°42'29"E).

Alburnoides petrubanarescui
Bogutskaya and Coad, 2009

Alburnoides petrubanarescui, Turkey, upper Nazlu Chay, Lake Urmia basin, after Kaya (2020).

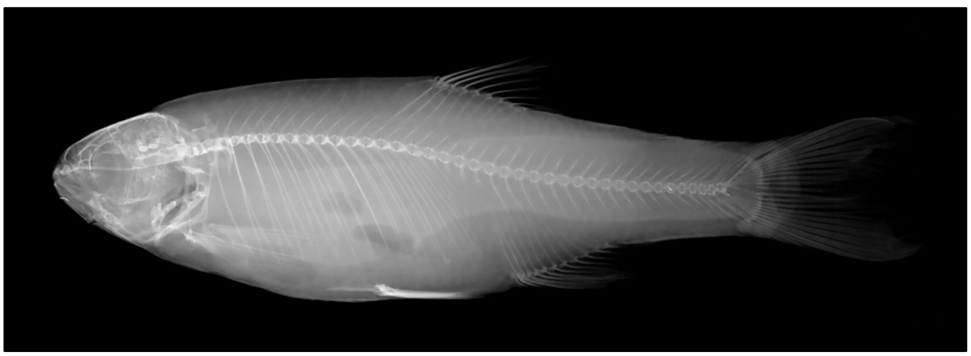
Common names. Khayateh-ye Orumiyeh or Oromiyeh (= Urmia tailor fish), lapak or lapek (meaning unknown).

[Banarescu's riffle minnow, Urmia or Urmian spirlin].

Systematics. The holotype is under CMNFI 1970-0558, female, 88.8 mm standard length, Iran, West Azarbayjan, Qasemlou Chay, Lake Urmia basin, ca. 37°21´N, 45°09´E. Paratypes are under CMNFI 1970-0558A, 51, 28.7-87.3 mm standard length, same locality as the holotype. The species is named after the late Petru Bănărescu who contributed significantly to our knowledge of the fishes of Eurasia.

Alburnoides petrubanarescui, holotype, CMNFI 1970-0558, James Maclaine @ Canadian Museum of Nature.

Alburnoides petrubanarescui, paratype, 65.5 mm standard length, CMNFI 1970-0558A, Bronwyn Jackson @ Canadian Museum of Nature.



Alburnoides petrubanarescui, holotype, CMNFI 1970-0558, Noel Alfonso @ Canadian Museum of Nature.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Lake Urmia basin. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a small eye, the orbit width about equal to the snout length but markedly smaller than the interorbital width, caudal fin lobes rounded and the fin shallowly forked, a scaled but not sharp ventral keel behind the pelvic fins along the abdomen to the anus, a deep head with a stout snout which is markedly rounded, the mouth is subterminal and the tip of the mouth cleft is on the level below the lower margin of the eye, the junction of the lower jaw and the quadrate is on about a vertical through the anterior eye margin, and the anal fin origin is below the posterior end of the dorsal fin base.

Dorsal fin branched rays 7-9, almost equally 7 or 8, anal fin branched rays 8-13, commonly 9-10, pectoral fin branched rays 11-15, pelvic fin branched rays 6-7, total lateral line scales 44-51 (42-50 scales to posterior margin of hypurals), the lateral line over the pectoral and pelvic fins can be wavy rather than a smooth decurved line, scales above lateral line to dorsal fin 9-11, scales around caudal peduncle 14-19 (mostly 15-17), total gill rakers 6-8, pharyngeal teeth 2,5-4,2 (or other variants with four teeth on the right ceratobranchial), and total vertebrae 39-42. The holotype has 41 total vertebrae.

Meristic values are:- dorsal fin branched rays 7(24), 8(25) or 9(1) and anal fin branched rays 8(3), 9(21), 10(15), 11(5), 12(4) or 13(1). Abdominal vertebrae 20(3), 21(25) or 22(2),

caudal vertebrae 19(15), 20(14) or 21(1), predorsal vertebrae 13(18) or 14(12), and total vertebrae 39(1), 40(14), 41(14) or 42(1) (Bogutskaya and Coad, 2009; material below).

Sexual dimorphism. Unknown.

Colour. The lateral line is clearly delineated by darker pigment above and below, forming an evident pale line margined with dark. Overall colour is golden to olive. The operculum is silvery. The bases of the pectoral, pelvic and anal fins are orange. The belly and extreme lower flank are silvery. The upper iris margin of the pupil is yellow. Some pigment on flank scales above and below the lateral line give the impression of stripes. A mid-flank stripe is evident. The back is dark and obscures a predorsal and postdorsal stripe. The fins are mostly immaculate, with some melanophores lining the rays of the dorsal and pectoral fins. The unbranched pectoral fin ray is strongly lined with melanophores on its inner margin in some fish. The peritoneum is silvery with fine melanophores and some large spots.

Size. Attains 88.8 mm standard length (Bogutskaya and Coad, 2009).

Distribution. This species is found in the Lake Urmia basin in the Aji (= Talkheh), Balanoosh, Baranduz, Mardogh, Nazlu, Qasemlu, Simineh, Sufi and Zarrineh rivers **(**Banan Khojasteh *et al*., 2012; Ghasemi *et al*., 2015; Keivany and Zamani-Faradonbeh, 2016; Kaya, 2020).

Zoogeography. An endemic in the Lake Urmia basin, its closest relatives may lie in the Caspian Sea basin as shown with other Lake Urmia fish.

Habitat. Habitat data for the type locality (June 1962) were water temperature 18°C, fast current in stream, pebble and sand bottoms, shore grassy, much aquatic plant life, and other cyprinoids were *Alburnus atropatenae* and *Barbus cyri*.

Age and growth. Azh *et al*. (2012) gave a life span up to 3^+ years. Keivany and Zamani-Faradonbeh (2016) gave a *b* value of 3.19 for 34 fish, 2.25-7.53 cm total length, from the Talkheh (= Aji) River in the Lake Urmia basin.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. Ahmadiara *et al*. (2013) described the rate of infection of the cestode *Ligula intestinalis* in fish identified as *A. bipunctatus* (= *A. petrubanarescui*) from Maragheh, presumably the Sufi River.

Economic importance. None.

Experimental studies. None.

Conservation. Numerous sampling efforts at the type locality and around it have failed to locate modern material and the locality is polluted (Jouladeh-Roudbar *et al*., 2015, 2020). Listed as Critically Endangered by Jouladeh-Roudbar *et al*. (2020) as, in addition to the above, the region has suffered drastically from drought, drying permanently or periodically many rivers in this region. The species may exist in some isolated spots or in dam reservoirs but was thought possibly to be extinct. However, Kaya (2020) recorded specimens from the upper reaches of the Nazlu Chay in Turkey just across the border from Iran. The Nazlu Chay drainage lies just north of the Baranduz Chay and Qasemlu Chay drainages. He noted that the original collection could have been mislabeled after Jörg Freyhof (pers. comm., 2019) but Vadim D. Vladykov's handwritten field label reads "Ghasemlou Chai June 27, 1962" and he also collected other fishes from the "Barandous Chai", which is nearby, on this date.

Sources. Type material:- *Alburnoides petrubanarescui* (CMNFI 1970-0558 and CMNFI 1970-0558A).

Iranian material:- CMNFI 2007-0097, 6, 38.2-54.6 mm standard length, West Azarbayjan, Baranduz Chay basin (ca. 37º16'N, ca. 45º08'E).

Alburnoides qanati
Coad and Bogutskaya, 2009

Alburnoides qanati, Fars, Kor River, Jörg Freyhof.

Alburnoides qanati, Yazd, Harat, Hamd Reza Esmaeili.

Alburnoides qanati, Fars, Moshkan near Safashahr, Hamid Reza Esmaeili.

Alburnoides qanati, a, 65.0 mm standard length, b, 59.0 mm standard length,
VMFC AL201QA, Fars, Kor River, Hamed Mousavi-Sabet.

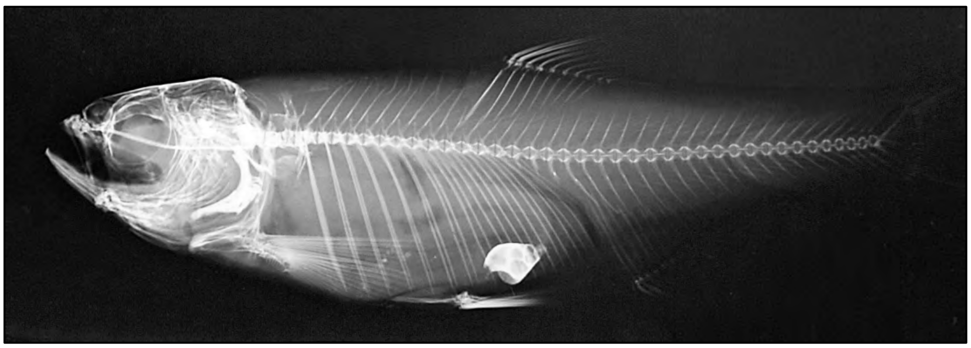
Common names. Khayateh-ye Fars (= Fars tailor fish), khayateh-e qanati (qanat tailor fish), lapak or lapek (meaning unknown).

[Fars spirlin, Kor spirlin, qanat spirlin, qanat tailor fish (Tahami *et al*., 2015; Jouladeh-Roudbar *et al*., 2020)].

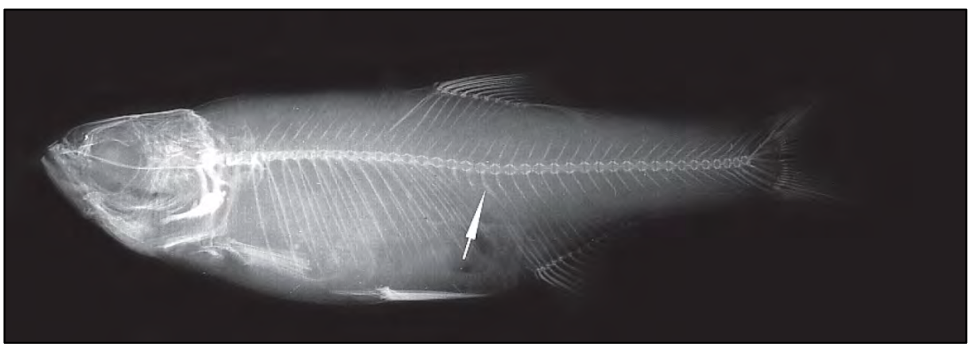
Systematics. The female holotype is under CMNFI 1977-0509, 81.5 mm total length, 65.0 mm standard length, Fars, at source and along stream of a qanat at Naqsh-e Rostam, Pulvar River system (29°59'30"N, 52°54'00"E). Paratypes are under CMNFI 1977-0510, 168 (not 178 as in type description) specimens, 24.9-72.5 mm standard length, same data as holotype. The species was named after the famous qanat system which taps groundwater to support human survival in desert regions and, incidentally, is a habitat for fishes.

Alburnoides qanati, holotype, CMNFI 1977-0509,
James Maclaine @ Canadian Museum of Nature.

Alburnoides qanati, paratype, CMNFI 1977-0510,
Bronwyn Jackson @ Canadian Museum of Nature.



Alburnoides qanati, holotype, CMNFI 1977-0509,
Noel Alfonso @ Canadian Museum of Nature.



Alburnoides qanati, 58.0 mm standard length, paratype, CMNFI 1977-0510,
the arrow shows the first caudal vertebra, after Coad and Bogutskaya (2009).

Esmaeili *et al*. (2011) were able to separate individuals from three populations (Beiza, Moshkan and Safashahr) based on combined meristic and morphometric characters.

Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and found this species to be distinct.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution in the Kor River and Sirjan basins. Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a large eye, the orbit width exceeding both the snout length and the interorbital width, a scaled ventral keel behind the pelvic fins along the abdomen to the anus, lateral line scales commonly 43-47, dorsal fin branched rays commonly 8, anal fin branched rays 10-12, and total vertebrae 40-41.

The body is markedly compressed. The upper body profile is convex or, in larger specimens, slightly to markedly straightened while the lower profile is considerably convex. The ventral keel between the pelvics and anal fin is not sharp and is completely covered by scales in all specimens but four possessing a short scaleless portion of keel (about half of keel length) just in front of the anus. The dorsal fin outer margin is truncate to slightly rounded and the anal fin outer margin is truncate to slightly concave. The anal fin origin is behind the posterior end of the dorsal fin base. The snout is short and slightly pointed. The mouth is terminal to upturned, with the tip of the mouth cleft on a level from slightly above the middle of the eye to the upper margin of the pupil. The mouth cleft is always turned upward, never horizontal, the lower jaw slightly to moderately projecting relative to the upper jaw, and the junction of the lower jaw and the quadrate is on about a vertical through the anterior eye margin.

The lateral line is decurved and only the last few scales are elevated and on the mid-caudal peduncle. A pelvic axillary scale is present. The anal fin base is proximally overlain by flank scales. Total scale radii 8(1), 9(1), 10(4), 11(8), 12(20), 13(17), 14(16), 15(12), 16(7), 17(3) or 18(1). Esmaeili and Gholami (2009) gave scanning electron microscopy details of scales in fish identified as *A. bipunctatus*, but probably this species.

Meristic values are:- dorsal fin unbranched rays commonly 3, 4 in three specimens only, dorsal fin branched rays 7(9), 8(76) or 9(1), anal fin unbranched rays 3, anal fin branched rays 10(8), 11(62) or 12(16), pectoral fin branched rays 13(4), 14(20) or 15(7), and pelvic fin branched rays 7(30). The lateral line is complete with none, 1 or 2 unpored scales at the posterior end of the lateral series. Lateral line scales 41(1), 42(2), 43(7), 44(7), 45(10), 46(13), 47(9), 48(3) or 49(1), scales above lateral line to dorsal fin origin 9(10), 10(18) or 11(3), scales below lateral line to pelvic fin origin 3(4), 4(20) or 5(7), and scales below lateral line to anal fin origin 4(17), 5(13) or 6(1). Total gill rakers 6(4), 7(4), 8(21) or 9(1). Gill rakers are very short and widely spaced, not touching the adjacent raker when appressed. Pharyngeal tooth counts are 2,5-4,2 in 10 fish examined with one additional fish being a variant with 2,4-4,0. The gut shape is a simple s-shape with an occasional specimen showing a slight flexure to the left of the anterior loop. Abdominal vertebrae 20(61) or 21(3), caudal vertebrae 20(38) or 21(26), predorsal vertebrae 13(53) or 14(11), and total vertebrae 40(35) or 41(29). The vertebral formula is 20+20(16), 20+21(12) or 21+20(2). Thus, the caudal vertebral region most commonly (in 93% of examined specimens) is equal to or slightly longer than the abdominal region, the mean difference between abdominal and caudal counts being -0.3. The holotype has 41 total vertebrae (Bogutskaya and Coad, 2009; Mousavi-Sabet *et al*., 2015).

The general topography of cephalic sensory canals and numbers of pores is typical of most *Alburnoides*, as described by Bogutskaya (1988). The supraorbital canal is not lengthened in its posterior section and has 7-11, commonly 8-10 pores, with 2-4 (3 in 90%) and 5-7 (6 in 73%) canal openings on the nasal and frontal bones, respectively. The infraorbital canal has 10-15 pores (13 in 38%, 12 in 30%) with 4 (93%) or 5 canal openings on the first infraorbital. The preopercular-mandibular canal is complete, with 11-17, modally 13-16, pores (14 in 38%) with 3-6 (5 in 77%) and 7-10 (8 in 62%) canal openings on the dentary and preoperculum, respectively. The supratemporal canal is complete, with 4-7 (7 in 54%) pores.

Sexual dimorphism. Head length, pectoral fin length and pelvic fin length are longer in

males than in females.

Colour. Pigmentation of the holotype in 5% formalin consists of a dark lateral line dividing the hypaxial and epaxial muscle masses and a weakly developed stripe of black pigment on mid-flank prominent posteriorly on the caudal peduncle but fading over the pectoral fin and often interrupted anteriorly. The lateral line pores are lined by pigment dorsally and ventrally. A mid-dorsal line is apparent before the dorsal fin, weakly developed behind the fin. The fins are mostly hyaline with some black pigment lining the fin rays of the dorsal and caudal fins, the dorsal rays of the pectoral fins and the anterior rays of the anal fin.

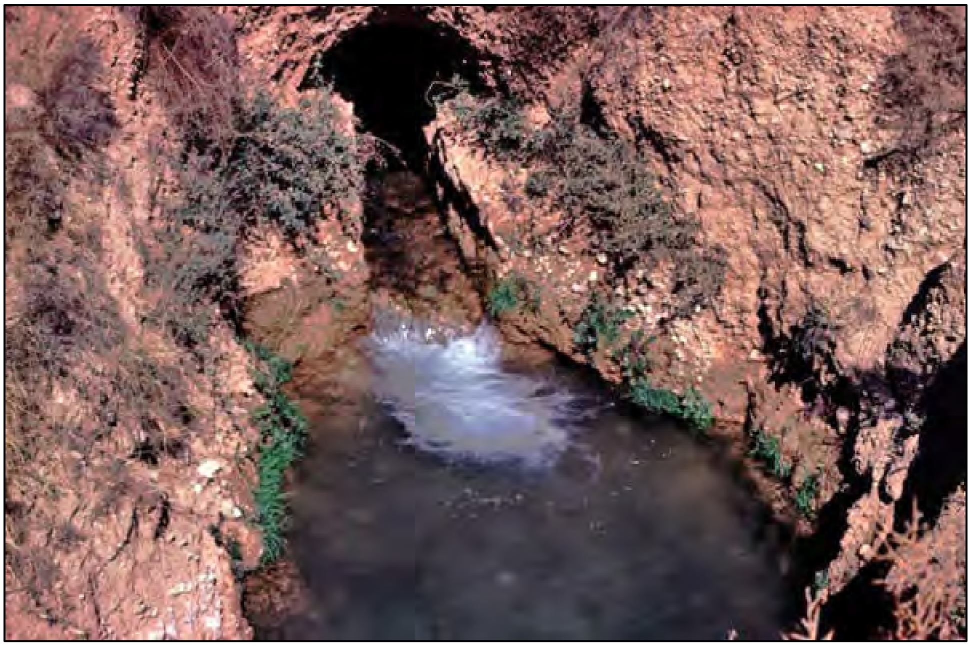
Overall colouration in life is silvery to yellowish-brown with the bases of the pectoral, pelvic and anal fins pink to orange. The head below and behind the eye is silvery and there is a thin yellow bar at the anterior margin of the operculum. The flank scales may have little or no pigment or large numbers may be dark (but with a pale surround) giving the flanks above and below the lateral line a spotted appearance and, since scale rows are in lines, an appearance of interrupted stripes. An orange line parallels the anal fin base and the lateral line, lying midway between the two. The ventral surface of the head between the dentaries may be yellow-orange and similarly coloured spots may be found on either side of the dorsal mid-line extending along the whole body. Faint yellow spots occur in rows along the flanks also. Pigmentation in preserved fish is as described for the holotype although the lateral stripe is weakly-developed in some specimens, the mid-flank band of spots of black pigment may be variably developed, and the lateral line may be clearly or only faintly edged by pigment. The peritoneum is rarely dark brown but usually is white-grey to light brown with black spots.

Size. Attains 11.9 cm total length (Tahami *et al*., 2015).

Distribution. This species is known from the Kor River and Sirjan basins. In the Kor River basin recorded from the Ghadamgah and Moshkan Spring-Stream systems, Kaftar Lake, Kor, Marghan and Pulvar rivers, Gomban Spring and Sarab-e Beyza (= Beiza Spring) (Esmaeili and Gholami, 2009; Teimori *et al*., 2010; Tahami *et al*., 2015, 2018; Gholamifard and Kafaei, 2021); and in the Sirjan basin reported from the Masih Spring at Harat (or Herat) at 30º01.196'N, 54º20.33'E (material from H. R Esmaeili, 2011; cytochrome *b* data also places these fish with *A. qanati* (H. R. Esmaeili, 6 October 2011; Jouladeh Roudbar *et al*., 2016)).

Zoogeography. This is the southernmost *Alburnoides* species and may have entered the Kor River basin by headwater capture from the Tigris-Euphrates River basin or via a route from the Persis basin.

Habitat. This species is found in rivers, streams, lakes, dams, springs, qanats and irrigation channels. The qanat stream in the Pulvar River basin at 1500 hours on 6 October 1976 had clear and colourless water, a temperature of 21°C, pH 6.8, conductivity 0.475 mS, the current was slow to medium, stream width was about 2 m and maximum depth was up to 1 m, the shore was grassy, plant life in the stream consisted of encrusting and submergent types, and the stream bed was gravel and mud. The Harat locality was at an altitude of 1,585 m, pH 8.17, dissolved oxygen 7.25 mg/l, , and temperature 22.9-23.3°C. Other localities had a temperature range of 16-22°C, pH 5.9-6.8, conductivity 0.48 mS, stream width 1-3 m, water depth 75 cm, water clear, slow to medium current, concrete, bedrock, stone, gravel and mud bottoms, encrusting, submergent, emergent and floating vegetation including filamentous algae and reeds.



Type locality of *Alburnoides qanati*,
Fars, qanat mouth and stream origin at Naqsh-e Rostam, Brian W. Coad.

Habitat of *Alburnoides qanati*, Yazd, Harat, Hamid Reza Esmaeili.

Age and growth. Tahami *et al*. (2015) examined fish from the Moshkan Spring-Stream system and found *b* values were 3.3-3.45 for 219 females, 21.02-102.96 mm standard length, and 3.32-3.44 for 168 males, 20.76-75.06 mm standard length, asymptotic length (L_∞) = 123.9 mm and growth coefficient (K) = 0.31/yr for females and 93.0 mm and 0.49/yr for males, growth performance index (Ø') = 8.47 for females and 8.35 for males, total mortality (Z) = 1.56/yr for

females and 1.14/yr for males, and natural mortality (M) = 0.44/yr for females and 0.65/yr for males. Males grew rapidly and initially and reached a larger size earlier in life than females. Females grew larger than males. Mortality parameters were lower as this spring-stream system has no predators compared to other *Alburnoides* spp. populations in Iran. Mousavi-Sabet *et al*. (2017) examined 30 fish, 48.3-75.2 mm total length, from the Kor River and found a *b* value of 3.11. Eagderi *et al*. (2020) examined 35 fish, 5.81-10.4 cm total length, from the Kor River and found a *b* value of 3.11, isometric growth. The condition factor was 0.74-1.09, mean 0.93.

Food. Tahami *et al*. (2015) found fish from the Moshkan Spring were omnivores feeding on Cyanophyta, Arthropoda (*Gammarus* and Trichoptera with the highest frequency), Bacillariophyta, Chlorophyta and Euglenophyta. An x-ray of the holotype of *A. qanati* shows a snail in the gut.

Reproduction. Tahami *et al*. (2018) studied reproduction in the Moshkan Stream based on 395 fish. The sex ratio was 1:1, except for those in January and April when they were biased in favour of females. Based on the percentage of the late gonad maturation stage (V) and high frequency of large oocytes (up to 0.7 mm), it was concluded that spawning occurred in spring with its peak in April. These results were in accordance with the three reproductive indices (gonadosomatic, modified gonadosomatic and Dobriyal). Absolute fecundity was between 732 and 2,368 (2,567 in a table) eggs and relative fecundity 9.9-27.4 eggs/g body weight. Studies on the eggs by scanning electron microscopy revealed they were adhesive, which could explain its low fecundity compared to other cyprinoids during spring.

Parasites and predators. None reported.

Economic importance. None.

Experimental studies. None.

Conservation. The numbers and wider distribution of this species should be researched as it is known from only two basins. Jouladeh-Roudbar *et al*. (2020) however listed it as of Least Concern since it has a relatively large distribution range, is abundant to very abundant and lacks any known widespread threat. Esmaeili *et al*. (2011) found morphological heterogeneity between three samples and suggested that this be considered in conservation management and stock enhancement programs, especially during drought conditions in the region.

Sources. Type material:- *Alburnoides qanati* (CMNFI 1977-0509 and CMNFI 1977-0510).

Iranian material:- CMNFI 1979-0060, 4, 21.0-35.4 mm standard length, Fars, spring and jube, 7 km north of Sa'adatabad (30°06'N, 53°12'E); CMNFI 1979-0069, 3, 35.4-56.2 mm standard length, Fars, qanat at Naqsh-e Rostam (29º59'30"N, 52º54'E); CMNFI 2008-0257, 2, 57.2-61.0 mm standard length, Fars, Marghan River near Sepidan (30º30'14"N, 51º53'19"E).

Alburnoides samiii

Mousavi-Sabet, Vatandoust and Doadrio, 2015

Alburnoides samiii, Gilan, Haviq River, Hamid Reza Esmaeili.

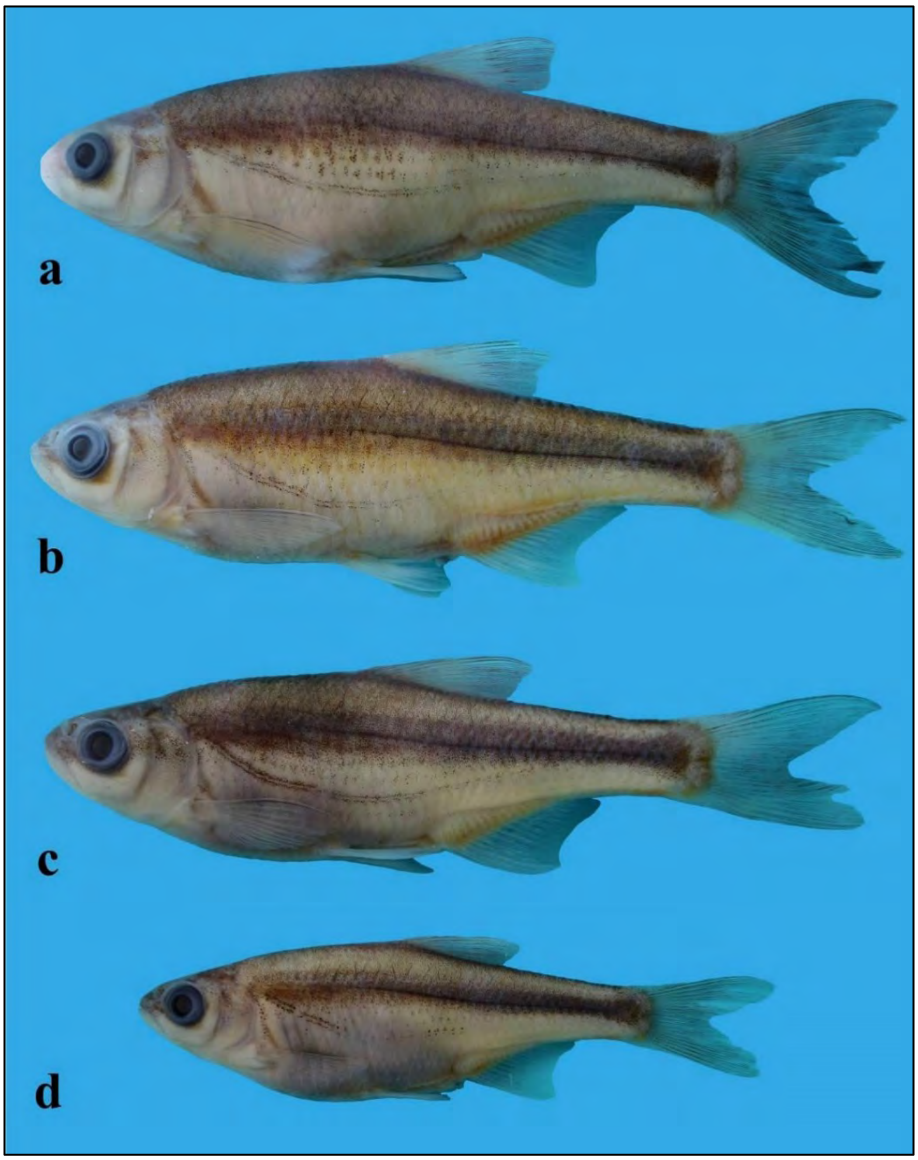
Alburnoides samiii, Gilan, Kargan River, Hamid Reza Esmaeili.

Alburnoides samiii, a, 67.0 mm standard length, b, 59.0 mm standard length, Gilan, Tutkabon Stream, Hamed Mousavi-Sabet.

Common names. Khayateh-e Samii (= Samiii's tailor fish), lapak or lapek (meaning unknown). **[**Samii riffle minnow, Samiii's spirlin, Sefidrud spirlin].

Systematics. The holotype is under VMFC-ALS4-H (VMFC = Vatandoust and Mousavi-Sabet Fish Collection, Tehran), 75.9 mm standard length, Guilan Province, upper Sefidroud River drainage, Tutkabon Stream, 36º50.756′N, 49º35.021′E. Paratypes are under VMFC-ALS4-P1 to VMFC-LS4-P45, 45, 52.9-81.5 mm standard length and GUIC-ALS4-P1 to GUIC-ALS4-P4 (GUIC = Ichthyological Museum of the University of Gilan), 4, 56.2-63.5 mm standard length, collected with the holotype. The species name *samiii* is in honor of Professor Doctor Majid Samii the world-famous Iranian neurosurgeon and medical scientist, born 19 June 1937 in Rasht, the capital city of Gilan Province, the region where the type locality of the new species is located.

Alburnoides samiii, holotype, VMFC-ALS4-H, Hamed Mousavi-Sabet.



Alburnoides samiii, paratypes, a**,** 75.0 mm standard length, VMFC-ALS4-P2,
b**,** 76.0 mm standard length, VMFC-ALS4-P3, c**,** 68.0 mm standard length, VMFC-ALS4-P4,
d**,** 53.0 mm standard length, VMFC-ALS4-P5, Hamed Mousavi-Sabet.

Eagderi *et al*. (2013) examined fish identified as *A. eichwaldii* from the Sefid (= *A. samiii* by distribution; and for others below), Valam and Gorgan (both = *A. tabarestanensis*) river basins morphometrically and found habitat-associated morphological divergence, phenotypic plasticity and evolutionary changes in body shape, as well as geographical distance being a factor. Fish from two streams in the Sefid River basin were not significantly different. Haghighy *et al*. (2013) compared fish identified as *A. eichwaldii* morphometrically from the Kargan (= *A. samiii*) and Chalus (= *A. tabarestanensis*) rivers and were able to separate the two populations, attributing the variables to environmental factors such as water flow, river slope, physicochemical conditions of the water and feeding conditions. Astara, Kargan and Lamir (= Lomir) river populations in Gilan identified as *A. eichwaldii* were distinguishable on morphometry (Haghighy *et al*., 2013). Eagderi *et al*. (2014) compared fish identified as *A. eichwaldii* morphometrically above and below the Tarik Dam on the Sefid River, finding a smaller head, shorter snout, smaller caudal peduncle depth and smaller eye diameter in the upstream population, perhaps related to altered habitats and hydrological conditions. Haghighy *et al*. (2015) compared fish from the Kargan and Lamir (= Lomir) rivers identified as *A. eichwaldii* finding meristic characters (caudal peduncle scales, scales above the lateral line and anal fin rays) could separate the populations but not morphometric characters. However, they cited nine meristic and 19 morphometric characters that were significantly different between the populations. Hosseini *et al*. (2016) described the genetic structure of fish identified as *A. eichwaldii* from three sections of the Polrud (= Pol-e Rud) using five microsatellite markers, finding an acceptable level of allelic richness and considerable genetic diversity. Vajargah and Hedayati (2014) examined morphometrically 35 fish identified as *A. eichwaldii* from the Vajargah River, Gilan (appropriately) both before, and six months after, preservation in 10% formalin. Total and standard length showed shrinkage while head length increased, the latter attributed to water and formalin absorption in gill tissue. Jahangiri and Shabany (2016) studied microsatellite polymorphism in fish identified as *A. eichwaldii* from the Kaboodval and Sefid rivers and found allelic diversity and genetic variation were at an acceptable level, most variation was within populations and genetic distance indicated that the populations were separate (now *A. tabarestanensis* and *A. samiii* respectively). Mousavi-Sabet and Heidari (2019) investigated the morphology of 30 fish from above, and 30 fish below, the Sefid River dam and a discriminant analysis classified 97.1% of individuals into their original population. Different habitat conditions caused by the dam may have led to different morphologies. Vajargah *et al*. (2020) examined 100 specimens morphometrically from the Toolkhone River, Gilan from populations isolated above and below a flood dam about 10 years ago. Significant differences were found in morphological variables associated with hydrodynamic balance and swimming ability despite this short separation time, namely a more streamlined body, smaller body width and total length, upstream where water velocity was higher.

Levin *et al*. (2018) used DNA barcoding (cytochrome c oxidase subunit 1) to assess the *Alburnoides* species of the Caucasus and neighbouring areas and found this species to be distinct.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution principally from the Sefid River basin (or just east) and then west in the Caspian Sea basin of Iran (except the Aras River basin in Iran which has *A. eichwaldii*, *q.v.*). Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. This species is characterised by a terminal mouth, with the tip of the mouth cleft on a level with the middle of the eye or below, a mostly or completely scaled ventral keel, the lack of well-marked spots or dark pigmentation in the lateral line canal, the dorsal fin outer

margin truncate to slightly concave, the anal fin outer margin markedly concave, a large eye (eye diameter about equal to interorbital width), a long and shallow caudal peduncle (its length 22.8-26.5%, mean 24.5%, in standard length), a shallow head (head depth 61.2-74.6%, mean 68.9%, in head length), caudal fin lobes are pointed and the fin is clearly forked, dorsal fin branched rays 7-9, usually 8, anal fin branched rays 10-16, pectoral fin branched rays 11-16, usually 12-13, pelvic fin branched rays 6-8, usually 7, lateral line scales 41-56, total gill rakers 5-10, total vertebrae 39-42, commonly 40-41, predorsal vertebrae 11-14, commonly 12-13, abdominal vertebrae 19-21, and caudal vertebrae 19-22.

Meristic values are:- dorsal fin branched rays 7(9), 8(195) or 9(5), anal fin branched rays 11(10), 12(59), 13(112), 14(57), 15(12) or 16(1), pectoral fin branched rays 11(9), 12(30), 13(54), 14(61), 15(21) or 16(6), and pelvic fin branched rays 6(8), 7(159) or 8(11). Lateral line complete with 0-2 unpored scales at the posterior end of the lateral series. Lateral line scales 43(4), 44(5), 45(24), 46(26), 47(27), 48(28), 49(24), 50(15), 51(12), 52(7), 53(1), 54(2), 55(2) or 56(1), scales above lateral line to dorsal fin origin 8(4), 9(41), 10(67), 11(54), 12(9) or 13(2), scales below lateral line to anal fin origin 3(8), 4(60), 5(65), 6(42) or 7(2), scales below lateral line to pelvic fin origin 3(6), 4(87), 5(72), 6(11) or 7(3), and scales around the caudal peduncle 14(1), 15(9), 16(33), 17(29), 18(35) or 19(8). Total scale radii 15(4), 16(14), 17(14), 18(16) or 19(2). Total gill rakers 5(1), 6(4), 7(35), 8(79), 9(54) or 10(5). Pharyngeal teeth are 2,5-4,2(10). Abdominal vertebrae number 19(41), 20(108) or 21(16), caudal vertebrae 19(9), 20(79), 21(76) or 22(2) predorsal vertebrae 11(1), 12(73), 13(84) or 14(7), and total vertebrae 39(5), 40(96), 41(62) or 42(2). The caudal vertebral region is most commonly equal to the abdominal region or one vertebra longer than it. Most common vertebrae formulae are 19+20, 19+21, 20+20 or 20+21 (Bogutskaya and Coad, 2009; Coad and Bogutskaya, 2012; Mousavi-Sabet *et al*., 2015; material below).

Sexual dimorphism. A fish from CMNFI 1979-0452, 51.2 mm standard length caught on 8 June 1978, has very small tubercles on the top of the head and on the side of the head in the opercular region. Slightly larger ones are present along the mid-line of the back to the dorsal fin origin with 1-2 on each rear scale margin. Tubercles on the back behind the dorsal fin are only present near the caudal fin. Scales over the anal fin have 1-4 tubercles lining the scale margin. Tubercles are also present on scales on the upper flank and on the lower flank from the level of the end of the dorsal fin back to the caudal fin. Tubercles are present on the unbranched and up to six branched rays of the pectoral fin, and follow the terminal branches of the rays. The pelvic fin has a similar pattern on up to four branched rays in addition to the unbranched ray. All dorsal and anal largest unbranched and all branched rays bear tubercles.

Colour. Overall colouration is silvery, with the bases of the pectoral, pelvic and anal fins orange. The back and top of head are light to dark grey, with an olive hue. The lower portion of the head and body are pearly-white. Facial bones and opercle are silvery. The flanks above the lateral line may have golden and/or cobalt-blue hues. Faint yellow spots occur in rows along the flanks. Faint dark pigmentation on flank scales above the lateral line form diffuse stripes, and are present only as scattered dark pigmentation below it. Dorsal, anal and caudal fins have either some grey pigmentation or are dark grey. Preserved fish are overall tan to cream, darker dorsally. Horizontal rows of dark blotches formed by dark pigmentation are concentrated on the middle of scales, moderately conspicuous, above the lateral line. The lateral line has some scales with pores outlined with dark pigmentation, especially the anteriormost scales. A relatively thick dark stripe is present at the caudal peduncle. A narrow dark midlateral stripe runs along the lateral septum, less discernible from the vertical through the dorsal fin onwards. Fins are mostly

hyaline, with some black pigmentation lining dorsal and caudal fins rays, dorsalmost pectoral fin rays and anteriormost anal fin rays.

Size. Reaches 11.6 cm total length (Asadi *et al*., 2017).

Distribution. This species is recorded from the Caspian Sea basin. All *Alburnoides* from principally the Sefid River basin (or just east) and west in the Caspian Sea basin of Iran (except the Aras River basin in Iran) are here allocated to *A. samiii*. There may be some *A. eichwaldii* (*q.v.*) in the westernmost Caspian Sea basin of Iran adjacent to Azerbaijan but DNA data is needed to confirm this. There may be some overlap in distribution with *A. tabarestanensis* as far east as the Chalus River (51º25'E) but this remains to be refined (Jouladeh-Roudbar *et al*., 2020; and see below under *A. tabarestanensis*).

Found in the Alamut, Astara, Barkili, Chalkheh, Chavrud, Chelond, Chelvand, Chenar Rudkhan, Chubar, Dorudkhan, Gohar, Haviq, Kargan, Khow'in, Lasht Nesha', Lavandevil, Lisar, Lomir, Masoleh, Masuleh-Rukhan, Molahadi, Nahang Roga, Nesa, Pir Bazar, Polrud (= Pol-e Rud), Qal'eh, Qalehrudkhan, Qezel Owzan, Safa (presumably Shafa), Sajas, Sefid, Shafa, Shah, Shahrbijar, Shalman, Siah, Taleghan (= Taleqan), Toolkhone, Tutkabon, Vajargah, Zanjan and Zalki (presumably Zeleki) rivers, the Karfestan Ab-bandan at Rudsar, the Anzali Talab and tributaries, and the Golabar, Manjil, Nazdik, Taham, Tarik and Zire dams (Karimpour, 1998; Nazari, 2002; Aghili *et al*., 2008; Abdoli and Naderi, 2009; Ashoori, 2010; Mirzajani, 2010; Mirzajani *et al*., 2012; Seifali *et al*., 2012; Haghighy *et al*., 2013; Vajargah and Hedayati, 2014; Mousavi-Sabet *et al*., 2015; Zamani Faradonbeh *et al*., 2015; Jouladeh Roudbar *et al*., 2016; Abbasi *et al*., 2017; Babaei, 2017; Matveyev *et al*., 2017; Boroumandi *et al*., 2018; Shahnazari *et al*., 2020; Vajargah *et al*., 2020; Aazami and Alavi Yeganeh, 2021; Abbasi *et al*., 2021, 2021).

Also recorded via DNA barcoding in the Lenkoran River of Azerbaijan where it co-occurs with *A. eichwaldii* (Levin *et al*., 2018), indicative perhaps of a presence in neighbouring Iran.

Gilan, Gohar River in Rasht
(Gohar Rud (The river in 2008 Snow) – panoramio, CC BY-SA 3.0, Mehrab Pourfaraj).

Zoogeography. See under the genus.

Habitat. This species is found in rivers and streams, and may occur in Caspian Sea estuaries. The upstream portion of Sefid River at the type locality had clear water, water flow was medium, the stream width was about 5-15 m and maximum depth was up to 1.5 m, and the stream bed was rock and gravel. Other species collected were the cyprinids *Barbus lacerta* (= *B. cyri*), *Capoeta gracilis* (*sic*, presumably *C. razii*), *Luciobarbus capito*, *L. mursa* and *Squalius cf. orientalis* (= *S. turcicus*) the cobitid *Cobitis keyvani*, the nemacheilid *Oxynoemacheilus bergianus* and the gobiid *Ponticola iranicus*.

Type locality of *Alburnoides samiii*, Gilan, Tutkabon River, upper Sefid River basin, Hamed Mousavi-Sabet.

This species, identified as *A. eichwaldii*, had the highest frequency in the Siah River (Sefid River basin) especially in upstream reaches (Asadi *et al*., 2014a). It preferred well-oxygenated water, low in pollution, with hard stream beds. Asadi *et al*. (2014b) also found the main habitat requirements governing presence in the Tutkabon River (a Sefid River tributary) of fish identified as *A. eichwaldii* were depth and width of the river. Asadi *et al*. (2016) examined this species (as *A. eicwaldii*, *sic*) in the Tootkabon (= Tutkabon) River at 13 sites. They found this species with *Alburnus filippii*. The sampling sites were 130-230 m above sea level, 15-75 cm water depth, 1.5-13 m wide, 0.35-0.71 m/s water velocity, 0.4-2.4% slope, stone diameter 10-50 cm and also cobble and bedrock substrate, the most available cover was boulders, and the riparian habitat was deciduous forest. The habitat selection pattern of *A. samiii* was elevation higher than 180 m, water depth greater than 50 cm, channel width less than 10 m, channel slope 0.5-1.5%, water velocity less than 0.72 m/s, bedrock substrate, average diameter of bed stones 30-50 cm, and deciduous forest and residential areas as the riparian type. This fish mostly selected upper parts of the river with higher water velocity, greater depth, and bedrock and larger bed stone substrates. These factors provided protection from predators, ameliorated seasonal changes in habitat, provided spawning habitat and allowed periphyton growth for food. The selection of deciduous forest and residential areas (rather than grassland or unvegetated riparian

areas) could be associated with organic matter input and the development of the riverine food chain. Mansouri-Chorehi *et al*. (2016) described a sample site from the lower Sefid River as 9.4-26.7°C, pH 7.29-8.04, dissolved oxygen 5-10 mg/l and water hardness 175.0-199.5 mg/l. Zarkami *et al*. (2019) examined fish identified as *A. eichwaldii* (presumably *A. samiii*) from seven sites, mouth to source, of the Shafarud or Shafa River for 42 fish presence and 42 fish absence data and found water quality variables had more contribution to the prediction than physical-habitat ones. The important variables were dissolved oxygen, pH, water temperature, river depth, electric conductivity, total hardness, nitrite, orthophosphate and sulphate. Three of the selected variables (dissolved oxygen, water temperature and pH) might increase the probability of fish presence.

Habitat of *Alburnoides samiii*, Gilan, Shafa River, Arash Jouladeh-Roudbar.

Age and growth. Mansouri-Chorehi *et al*. (2015) gave a *b* value of 2.9385 for 46 fish, mean total length 78.16 mm, from the Sefid River identified as *A. eichwaldii* (= *A. samiii* here and below). Zamani Faradonbeh *et al*. (2015) found a *b* value of 3.056 (isometric growth) and a condition factor of 0.89 for 62 fish identified as *A. eichwaldii*, 48.8-101.4 mm total length, from the Tutkabon River. Mansouri-Chorehi *et al*. (2016) examined 312 fish, 4.5-11.2 cm total length, from the Sefid River and the age range was 1^+ to 3^+ years, the majority was 2^+ years old (56.09%), some were 1^+ (30.77%) and a small percentage was 3^+ (13.14%). Sexual maturity was at 45 and 49 mm total length (1^+ in age) for females and males respectively. The overall ratio of females to males was 1:1.19. Mousavi-Sabet *et al*. (2016) examined 311 fish, 4.5-11.2 cm total length (the same sample as the preceding) and found a *b* value of 3.086. Values for 152 males, 127 females and 32 immature fish were 3.018, 3.155 and 3.362 respectively. K values in males and females were 0.76-2.76 and 0.78-1.46 respectively, with minimum values found in September and June and maximum values in June and February respectively. Amoui *et al*. (2017) examined fish from the Sefid River including 126 males, 44-95 mm total length, and 266 females, 36-102 mm, collected in the spawning season. The female:male sex ratio was 2.1:1, the length-weight relationship was $W = 0.000007L^{3.11}$ through the sampling period, and age was

determined as 1^+ to 4^+ years. Asadi *et al*. (2017) gave a *b* value of 2.985 for 52 fish, 24-116 mm total length, identified as *A. eichwaldii* from the Shahrbijar River, Gilan with a total length condition factor of 1.01. Mansouri-Chorhi *et al*. (2017) found a *b* value of 3.028 (positive allometric growth) for 50 fish from the Sefid River. Mousavi-Sabet *et al*. (2017) examined 30 fish, 62.2-101.2 mm total length, from the Sefid River and found a *b* value of 3.26. Eagderi *et al*. (2020) examined 41 fish, 6.43-10.83 cm total length, from northern Gilan and found a *b* value of 3.27, isometric growth. The condition factor was 0.8-1.39, mean 1.02.

Food. See under genus**.**

Reproduction. Mansouri-Chorehi *et al*. (2016) found the spawning period in the lower Sefid River started in May and continued until late September at 19.7-22.8°C. Oocytes ranged from 0.1 to 1.7 mm with a mean of 0.732 mm. They were largest in April (mean 1.1 mm) and May (1.14 mm) and lowest in November (0.51 mm). There was a peak in the number of yellowish-yolk oocytes (1.0-1.7 mm diameter) in May. The absolute fecundity varied from 763 to 2,901 eggs, mean 1,571.1, and relative fecundity was 88 to 412, mean 202.7. Fish examined by Amoui *et al*. (2017) from the Sefid River had the most frequent oocyte diameter at 0.6 and 0.7 mm with maximum oocyte diameter at 2.0 mm. The average potential and relative fecundities were calculated at 1,802 eggs and 351.6 eggs/g respectively.

Parasites and predators. Pazooki *et al*. (2005) recorded *Trichodina perforata* from fish identified as *A. bipunctatus* (presumably *A. samiii*) and Pazooki *et al*. (2006) recorded the monogeneans *Dactylogyrus vistulae*, *Gyrodactylus* sp. and *Paradiplozoon* sp., also from this species and both in waterbodies of Zanjan Province. Jahangiri *et al*. (2014) found bivalve mollusc glochidia in 3 of 25 fish sampled from the Sefid River identified as *A. eichwaldii*. Ashoori (2010) recorded that little egret chicks (*Egretta garzetta*) in the Karfestan Ab-bandan, Rudsar, Gilan Province were fed *A. bipunctatus eichwaldii* (= *A. samiii*).

Economic importance. None.

Experimental studies. None.

Conservation. Mansouri-Chorehi *et al*. (2016) found the Sefid River population was under pressure by habitat degradation and illegal sport fishing and urged habitat protection and a limited fishing activity. Jouladeh-Roudbar *et al*. (2020) listed it as of Least Concern because it is very abundant with a relatively large distribution range.

Sources. Mousavi-Sabet *et al*. (2015).

Iranian material:- CMNFI 1970-0506, 29, 33.5-58.3 mm standard length, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0511, 1, not kept, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0515, 3, 33.8-36.7 mm standard length, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0516, 43, 19.2-52.6 mm standard length, Gilan, Lomir River (38º14'N, 48º52'30"); CMNFI 1970-0518, 6, 34.3-50.4 mm standard length, Gilan, Haviq River estuary (38º10'N, 48º54'E); CMNFI 1970-0519, 18, 32.2-45.1 mm standard length, Gilan, Chelvand River (ca. 38º18'N, ca. 48º52'E); CMNFI 1970-0520, 2, 32.4-35.1 mm standard length, Gilan, Astara River (ca. 38º25'N, ca. 48º52'E); CMNFI 1970-0521, 3, 55.2-73.4 mm standard length, Gilan, Sefid River near Lulaman (no other locality data); CMNFI 1970-0522, 22, 40.4-80.3 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0536, 3, 71.9-89.6 mm standard length, Gilan, Siah River estuary near Rudbar (36º53'N, 49º32'E); CMNFI 1970-0537, 14, 30.5-78.8 mm standard length, Gilan, Shah River above Manjil Dam (36º44'N, 49º24'E); CMNFI 1970-0538, 1, 49.2 mm standard length, Gilan, Qezel Owzan River above Manjil Dam (ca. 36º44'N, ca. 49º24'E); CMNFI 1970-0546, 3, 57.1-69.4 mm standard length, Gilan, Sefid River canal (no other locality data); CMNFI 1970-0551, 1, 108.4

mm standard length, Gilan, Ghaleh (= Qal’eh) River near Fowman (37º13'N, 49º19'E); CMNFI 1970-0583, 16, 40.7-87.3 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1971-0327A, 6, 59.3-81.0 mm standard length, Gilan, Shafa River (37º35'N, 49º09'E); CMNFI 1979-0435, 3, 28.7-42.5 mm standard length, Gilan, stream west of Ramsar (36º57'N, 50º37'E); CMNFI 1979-0439A, 4, 53.4-72.2 mm standard length, Gilan, Shafa River (37º35'30"N, 49º05'30"E); CMNFI 1979-0440, 11, 53.7-88.6 mm standard length, Gilan, Lomir River (37º37'N, 49º02'30"E); CMNFI 1979-0441, 4, 52.4-55.7 mm standard length, Gilan, river 14 km south of Hashtpar (37º42'N, 48º58'E); CMNFI 1979-0443, 3, 39.0-44.2 mm standard length, Gilan, river 34 km north of Hashtpar (38º06'N, 48º53'E); CMNFI 1979-0444, 10, 37.1-55.8 mm standard length, Gilan, Chubar River (38º11'N, 48º52'30"E); CMNFI 1979-0445, 1, 70.6 mm standard length, Gilan, stream 10 km south of Astara (38º21'N, 48º51'E); CMNFI 1979-0452, 3, 47.1-51.7 mm standard length, East Azarbayjan, Qezel Owzan River 6 km from Mianeh (37º23'N, 47º45'E); CMNFI 1979-0453, 2, 45.8-65.1 mm standard length, Zanjan, Zanjan River (37º06'N, 47º56'E); CMNFI 1979-0454, 6, 39.6-56.0 mm standard length, Zanjan, Qezel Owzan River at Gilavan (36º47'N, 49º08'E); CMNFI 1979-0456, 4, 42.1-47.5 mm standard length, Gilan, Shah River at Lowshan (36º37'30"N, 49º31'E); CMNFI 1979-0626, 3, 46.6-62.2 mm standard length, Gilan, Sefid River (no other locality data); CMNFI 1979-0695, 74, 34.1-71.1 mm standard length, Gilan, Sefid River at Manjil Bridge (36º46'N, 49º24'E); CMNFI 1980-0116, 19, 41.1-70.3 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0147, 11, 19.0-42.7 mm standard length, Gilan, Lashtenesha (= Lasht Nesha’) River (37º21'N, 49º52'E); CMNFI 2007-0080, 12, 41.9-73.1 mm standard length, Zanjan, Khow’in River basin north of Qeydar (ca. 36º11'N, ca 48º36'E); CMNFI 2007-0081, 13, 44.0-85.9 mm standard length, Zanjan, Zanjan River near Soltaniyeh (ca. 36º27'N, ca. 48º45'E); CMNFI 2007-0106, 2, 52.3-60.7 mm standard length, Kordestan, Qezel Owzan River basin near Divan Darreh (ca. 35º52'N, ca. 47º05'E).

Alburnoides tabarestanensis

Mousavi-Sabet, AnvariFar and Azizi, 2015

Alburnoides tabarestanensis, Mazandaran, Talar River, Hamid Reza Esmaeili.

Alburnoides tabarestanensis, Mazandaran, Tajan River, Hamid Reza Esmaeili.

Common names. Khayateh-e Tabarestani (= Tabarestan tailor fish), lapak or lepak (meaning unknown).

[Tabarestan riffle minnow, Tabarestan spirlin, Tajan spirlin].

Systematics. The holotype is a male, 68.3 mm standard length, from Mazandaran Province, Tajan River, southern Caspian Sea basin, 36º11'N, 53º19'E under VMFC AL201MH (VMFC = Vatandoust and Mousavi-Sabet Fish Collection, Tehran). Paratypes are VMFC AL2049P, 45, 33.7-83.0 mm standard length, 19 males 35.5-74.6 mm standard length and 26 females 33.7-83.0 mm standard length collected with the holotype and GUIC ALT-P (GUIC = Ichthyological Museum of the University of Gilan), 4, 36.4-65.2 mm standard length, 2 males 36.4-47.2 mm standard length and 2 females 38-1-65.2 mm standard length collected with the holotype. The species is named for the historical region of Tabarestan.

Alburnoides tabarestanensis, a, holotype, VMFC AL201MH,
b, paratype, 66.0 mm standard length, VMFC AL2049P,
Mazandaran, Tajan River, Hamed Mousavi-Sabet.

Ahmadi *et al*. (2011) examined 809 fish, identified as *A. bipunctatus* (= *A. tabarestanensis* here and below) from the Talar River and its tributary the Keselian (= Kaslian) River and found 13 morphometric and seven meristic character differences. Fish identified as *A. eichwaldii* (= *A. tabarestanensis* here and below) from the Tilabad and Shirabad streams of Golestan showed low genetic differentiation between populations based on six microsatellite loci and most variation (99%) was within populations (Jahangiri, 2013; Jahangiri *et al*., 2013) but a population in the Kaboodval stream was separable (Jahangiri *et al*., 2014). Azizi *et al*. (2015, 2018) found moderate overlap in morphometry between populations identified as *Alburnoides* sp. (= *A. tabarestanensis*) above and below the Shahid Rajaei Dam on the Tajan River but suggested the two populations (50 fish each examined) were distinct through isolation. Eight of 53 morphometric characters and six of 16 meristic characters separated the fish in a principal components analysis and 93% morphometric and 78% meristic characters in a detrended fluctuation analysis. Ghojoghi *et al*. (2019) examined 95 fish from the Tilabad, Yelcheshmeh, Zarrin Gol and Zav rivers for 36 morphometric and nine meristic characters and were able to distinguish the populations on morphometry.

Key characters. This species is distinguished from other Iranian *Alburnoides* by a distribution along the eastern coast of the Caspian Sea, east of the Sefid River basin except the Atrak River (which has *A. parhami*, *q.v.*). Morphological characters overlap to varying degrees and reference should be made to the key above.

Morphology. The mouth is terminal with the tip of the mouth cleft between the level of

the middle of the pupil and its lower margin. The eye is relatively small, 23.6-34.0, mean 27.9 in head length.

Dorsal fin branched rays 7-9, usually 8, anal fin branched rays 11-14, usually 12-13, pectoral fin branched rays 11-16, usually 11-13, and pelvic fin branched rays 6-9, usually 7. Lateral line scales 45-55 (Esmaeilipoor Poode *et al*. (2015) gave 33-54 lateral line scales for fish from the Babol and Tajan rivers, the lower counts being suspect), typically scale rows between the lateral line and the dorsal fin origin 9-10, scale rows between the lateral line and the anal fin origin usually 4-5, and scales around the caudal peduncle 15-19. There is a completely scaleless ventral keel. There is a pelvic axillary scale and 0-2 unpored scales at the end of the lateral line. Total gill rakers number 7-10. Pharyngeal teeth are 2,5-4,2. Total vertebrae number 39-41 (Esmaeilipoor Poode *et al*. (2015) gave 34-41 total vertebrae for fish from the Babol and Tajan rivers, the lower counts being suspect). The caudal vertebral region is equal to or slightly longer than the abdominal region (vertebral formulae 19+20, 20+20 and 20+21).

Meristic values are:- dorsal fin unbranched rays 3, branched rays 7(4), 8(58) or 9(1), anal fin unbranched rays 3, branched rays 11(3), 12(31), 13(24) or 14(5), pectoral fin branched rays 11(10), 12(19), 13(24), 14(6), 15(3) or 16(1), and pelvic branched fin rays 6(5), 7(48) or 8(10). Lateral line scales 45(1), 46(1), 47(2), 48(23), 49(11), 50(10), 51(6), 52(7), 53(-), 54(1) or 55(1), scales above lateral line 8(4), 9(16), 10(34), 11(7), 12(1) or 13(1), scales below lateral line 3(4), 4(38), 5(18) or 6(3), and scales around the caudal peduncle 15(1), 16(1), 17(2), 18(7) or 19(2). Total gill rakers number 7(8), 8(24), 9(27) or 10(3). Pharyngeal teeth are 2,5-4,2(10). Abdominal vertebrae number 19(18) or 20(43), caudal vertebrae 20(31) or 21(30), predorsal vertebrae 12(49) or 13(12), and total vertebrae 39(14), 40(33) or 41(14) (Coad and Bogutskaya, 2012; Mousavi-Sabet *et al*., 2015; material below).

Sexual dimorphism. Morphometric characters differing between males and females are dorsal fin base, anal fin base, pectoral fin length, pelvic fin length (all longer in males) pectoral-pelvic distance, predorsal distance, preanal distance and pelvic-anal distance (all longer in females).

Colour. Overall colouration is silvery with the pectoral, pelvic and anal fin bases orange to red. The caudal fin is an overall reddish but less intense than the pectoral and anal fin bases. The back and top of the head are light to dark grey with an olive hue. The eye above the pupil is yellowish. The upper flank has a bluish hue. The lower part of the head and body are pearly-white. The flanks above the lateral line may have a golden hue. Faint yellow spots occur in rows along the flanks. Faint dark pigmentation on flank scales above and below the lateral line forms diffuse stripes. Dorsal and caudal fins have either some grey pigment or are dark grey. Dorsal, caudal and anal fins have dark pigment on their fin rays as does the pectoral fin unbranched ray. Preserved fish are overall tan, darker dorsally, and with horizontal rows of dark blotches formed by dark pigment on scale centres, moderately conspicuous above the lateral line. The lateral line has some scales with the pores outlined in dark pigment, especially anterior scales, but there is a general absence of well-marked spots or dark pigmentation in the lateral line canal. There is a narrow dark midlateral stripe along the lateral septum, more discernible from a vertical through the dorsal fin forwards. A faint midlateral stripe is also more discernible from the dorsal fin level anteriorly. Fins are mostly hyaline.

Size. Attains 15.0 cm (Abdoli, 2000).

Distribution. This species is recorded from the Caspian Sea basin presumably in all rivers of the southeastern Caspian Sea east of the Sefid River basin in Iran except the Atrak River. There may be some overlap in distribution with *A. samiii* as far west as the Chalus River

(51º25'E) but this remains to be refined (Jouladeh-Roudbar *et al*., 2020) and samples below are referred to *A. tabarestanensis*. DNA work would be needed to clarify any transitional zone as morphometric, meristic and key characters are variable and overlap in the two species and within samples.

Recorded from the Babol, Chalus, Cheshmeh, Dogh, Garmrud, Googgol, Gorgan, Haraz, Harisak, Kaboodval, Kelarud, Keslian or Keselian (= Kaslian), Lavij, Madar Su, Mobarakabad, Neka, Qonbad, Ramian, Safarud, Sardab, Shah, Shirabad, Shirin, Shirud, Siah, Tajan, Talar, Tilabad, Toji or Tuji, Tonekabon, Valam, Yasalegh, Yelcheshmeh, Zarrin Gol and Zav rivers, the Uzineh qanat in Golestan, and the Alborz Dam. sometimes as *A. cf. tabarestanensis* (Abdoli, 2000; Banagar *et al*., 2008; Abdoli and Naderi, 2009; Patimar *et al*., 2012; Seifali *et al*., 2012; Abbasi *et al*., 2013, 2014; Eagderi *et al*., 2013; Ghorbani *et al*., 2013; Mazaheri Kohanestani *et al*., 2013, 2014; Abdoli *et al*., 2014; Gholizadeh *et al*., 2014; Hosseinifard *et al*., 2014; Mousavi-Sabet *et al*., 2015; Jouladeh Roudbar *et al*., 2016, 2020; Ghojoghi *et al*., 2017, 2018; Matveyev *et al*., 2017; Taheri Mirghaed *et al*., 2017; Danaie *et al*., 2018; Rustami *et al*., 2018).

Zoogeography. See under the genus.

Habitat. This species is found in in rivers, streams, dams and qanats. The type locality on 14 February 2013 had clear, medium to fast water, gravel to mud bed, submergent plants and grassy shores, water 9.3ºC, pH 6.8, turbidity (*sic*, presumably conductivity) 1,130 µS, salinity 0.3 p.p.t., stream width about 3 m, and maximum depth up to 1.5 m. Other species present were the cyprinids *Barbus lacerta* (= *B. cyri*), *Capoeta gracilis* (= *C. razii*), *Luciobarbus capito*, *L. mursa*, *Squalius cephalus* (= *S. turcicus*), the cobitid *Cobitis faridpaki* and the nemacheilid *Paracobitis hircanica*. Mazaheri Kohanestani *et al*. (2013) examined fish from the Zarrin Gol Stream in Golestan identified as *A. eichwaldii* (= *A. tabarestanensis* here and below) and found that seasonal variations in haematological parameters reflected environmental conditions and the physiological status of the fish. Ghorbani *et al*. (2015) found a positive correlation with the amount of vegetation and channel insection for this fish identified as *A. eichwaldii* in the Tilabad Stream in Golestan. Naderi Jolodar *et al*. (2017) mentioned that fish identified as *A. bipunctatus* (= *A. tabarestanensis* here and below) was the dominant fish in the Tajan River at 44%. Rustami *et al*. (2018) found the abundance of fish from the Lavij River, Noor, Mazandaran identified as *A. eichwaldii* was influenced by changes in temperature and ammonium levels. Fazel *et al*. (2019) found *A. bipunctatus* presence in the Tilabad and Zarrin Gol streams was highly correlated with snag percent, pool and sand within streams.

Other collection data had a temperature range of 10-19°C, pH 6.0, conductivity 0.45-1.0 mS, clear to muddy water, medium to fast current, river width 2-12 m, water depth 50-100 cm, pebble, stone, sand and mud bottoms, and bushy and forested shores.

Habitat of *Alburnoides tabarestanensis*, Mazandaran, Talar River, Hamid Reza Esmaeili.

Habitat of *Alburnoides tabarestanensis* (and *Capoeta razii*),
CMNFI 1979-0483, Golestan, Cheshmeh River, 6 July 1978,
Brian W. Coad.

Age and growth. Ahmadi *et al*. (2011) examined 809 fish identified as *A. bipunctatus* (= *A. tabarestanensis* here and below) from the Talar River and its tributary the Keselian (= Kaslian) River and found four age classes with age group 2^+ dominant at 49%. The maximum length was 96.14 mm and the maximum weight was 9.27 g. Growth was negatively allometric. Seifali *et al*. (2012) examined 1,019 fish, 3.4-11.2 cm fork length, from the Kesselian Stream (or Kaslian River), identified as *Alburnoides* sp. (= *A. tabarestanensis* here and below). They found a length-weight relationship $W = 0.000006L^{3.1221}$ (isometric growth), asymptotic length (L_∞) = 104.48 mm, growth coefficient (K) = 1.19/yr, growth performance index (Ø') = 4.113, total mortality (Z) = 3.44/yr, fishing mortality (F) = 2.43/yr, natural mortality (M) = 0.97/yr and exploitation rate (E) = 0.71, indicating the stock was over exploited. Recruitment was continuous throughout the year with two major peaks, in June-July and November-December.

Fish identified as *A. bipunctatus* in the Tajan River showed negative allometric growth

with W = $0.014L^{2.901}$ (Patimar *et al*., 2012). Aazami *et al*. (2015b) gave a *b* value of 3.12 for 1,867 fish, 3.98-11.09 cm total length, from the Tajan River. Azizi *et al*. (2015) examined 621 fish identified as *Alburnoides* sp. from the Tajan River and found significant differences in length above and below the Shahid Rajaei Dam but differences in weight and condition factor only in males. The mean fork length and weight were 49.11 cm (*sic*, presumably mm) and 3.29 g above the dam and 52.94 cm (*sic*, presumably mm) and 3.92 g below. Upstream of the dam females had four age classes, 0^+ to 3^+ years, while males upstream and males and females downstream had three age classes, 0^+ to 2^+ years. Females dominated in the sex ratio both up- and downstream. Downstream males showed isometric growth while the rest showed positive allometric growth. Tabatabaei *et al*. (2015) investigated 43 Tajan River fish identified as *A. eichwaldii* and found *b* values of 3.27 (pooled sexes), 3.26 (females) and 3.3 (males). von Bertalanffy growth parameters were L_∞ = 123.01, K = 0.29, t_0 = -1.0 and Φ = 8.4. Age classes were 2^+ to 5^+ years, with the most abundant age class being 2^+. Mousavi-Sabet *et al*. (2017) examined 30 fish, 55.8-70.1 mm total length, from the Tajan River and found a *b* value of 3.09. Eagderi *et al*. (2020) examined 93 fish, 3.54-11.98 cm total length, from the Tajan River and found a *b* value of 2.98, isometric growth. The condition factor was 0.81-1.3, mean 1.0.

Patimar *et al*. (2012) examined 240 fish, 4.8-11.1 cm total length, from the Uzineh qanat in central Golestan Province identified as *A. bipunctatus*. They found a five-year life cycle (to age 4^+), length-weight relationships were W = $0.0068TL^{3.2559}$ for males, W = $0.0079TL^{3.2607}$ for females and W = $0.0072TL^{3.2387}$ for the population, positive allometric growth for all. The von Bertalanffy growth functions were $L_t = 14.07(1-e^{-0.27(t+0.92)})$ for males, $L_t = 15.37(1-e^{-0.23(t+1.08)})$ for females (indicating males grew faster than females) and $L_t = 14.83(1-e^{-0.24(t+1.04)})$ for the population. Nowferesti *et al*. (2014) found a *b* value of 3.29 for 21 fish, 2.5-6.2 cm total length, from Tilabad identified as *A. eichwaldii* (= *A. tabarestanensis* here and below). Monajjemi *et al*. (2014) examined a population (661 fish) from the Shirud in Mazandaran finding fish identified as *A. eichwaldii* to age 3^+, 0^+ fish dominating, *b* value was 2.94 (negatively allometric), von Bertalanffy parameters were L = 12.08, K = 0.55 and t_0 = -.0.47, growth performance index was up to 3.65, total mortality (Z) = 2.41, natural mortality (M) = 1.19 and fishing mortality (F) = 1.22.

Danaie *et al*. (2017) examined 203 fish identified as *A. cf. tabarestanensis* from the Mobarakabad River, Golestan and found a male:female sex ratio of 1:0.8 (no significant difference), the length-weight relationship for females was W = $0.0118\ TL^{3.03}$, for males was W = $0.0101TL^{3.12}$ and for the population was W = $0.011TL^{3.07}$ (positive allometric growth for the population and males, isometric for females), and the highest recorded condition factor was observed in males in May (1.01) and for materials (*sic*, presumably the population) in April (1.1). Danaie *et al*. (2018) again sampled fish identified as *A. cf. tabarestanensis* from the Mobarakabad River (325 fish) and found maximum total length and weight were 11.5 cm and 18.18 g for females and 10.5 cm and 11.48 g for males, a male:female sex ratio of 1:0.93 showing no significant difference between sexes, the length-weight relationship of females was W = $0.0091TL^{3.13}$, of males was W = $0.0091TL^{3.15}$, and of the total population was W = $0.0091TL^{3.14}$, all showing positive allometric growth, the condition factor showed the lowest value for both sexes in July and the highest value for males in March and for females in April, the highest instantaneous growth rate was observed for both males and females at zero to one year old, growth parameters were estimated as L_∞ = 122.4 mm for males, L_∞ = 127.14 mm for females and L_∞ = 133.53 mm for the population, von Bertalanffy growth equations were estimated as $L_t = 127.14(1-e^{-0.\ 15(t+1.\ 08)})$ and $L_t = 122.\ 4(1-e^{-0.\ 24(t+1.\ 07)})$ for female and male fish,

respectively.

Ghojoghi *et al*. (2017) studied 195 fish, 2.8-11.1 cm total length, identified as *A. cf. tabarestanensis* from the Zav Stream, a Gorgan River tributary, and found a sex ratio of 1:1.22 in favour of males but not significantly different from a 1:1 ratio, maximum age was 5^+ years with 2^+ years most common in both sexes, the highest growth rate was between 3^+ and 4^+ in females and between 4^+ and 5^+ in males, the length-weight relationship was $W = 0.0151TL^{2.9784}$ for males (negative allometric), $W = 0.0119TL^{3.1214}$ for females, and $W = 0.013TL^{3.067}$ for sexes combined (both positive allometric), the highest and lowest condition factors were in May and February, and the von Bertalanffy growth equations showed females grew faster than males and were $L_t = 12.9(1-e^{-0.23(t+0.664)})$ for males and $L_t = 13.97(1-e^{-0.23(t+0.156)})$ for females. Ghojoghi *et al*. (2018) examined 191 fish identified as *A. eichwaldii* from the Googgol River in the Gorgan River basin and found the largest male was 9.3 cm total length and the largest female was 10.2 cm total length, a sex ratio of 1:1, growth was positive allometric for both sexes and the population (*b* values for males, females and the population were 3.1277, 3.1527 and 3.1781), age groups 2^+ to 4^+ were present, and the von Bertalanffy growth equations were $L_t = 12.28(1-e^{-0.304(t+0.154)})$ for females and $L_t = 10.11(1-e^{-0.251(t+0.512)})$ for males.

Food. Tajan River fish identified as *A. eichwaldii* (= *A. tabarestanensis* here and below) were analysed for diet by Esmaeilpoor Poode *et al*. (2015) who found them to be gluttonous and tending to be carnivorous. Trichoptera was the preferred food of both sexes in different seasons and ages. The condition factor was higher in females than males. Abbasi *et al*. (2013) examined fish identified as *A. eichwaldii* from the Kaboodval, Shirabad and Tilabad streams in Golestan Province and found the most frequent prey was Diptera and Ephemeroptera, with Trichoptera and Amphipoda also significant with minor amounts of other taxa. Abbasi *et al*. (2014) found fish identified as *A. eichwaldii* in streams of the Gorgan River basin fed on Ephemeroptera, Trichoptera and Chironomidae as main foods and Odonata larvae, green algae, Simuliidae and Strachironomidae as accidental foods.

Reproduction. Patimar *et al*. (2012) found a qanat population at Uzineh, Golestan identified as *A. bipunctatus* (= *A. tabarestanensis*) had a sex ratio not significantly different from parity, the reproductive season extended from April to August with peaks in April, June and August for females and April and June for males. Absolute fecundity was 234-7,728 eggs, mean 1,407, relative fecundity was 60-550 eggs/g, mean 255 eggs/g, and egg diameters attained 1.7 mm. Seifali *et al*. (2012) found Kesselian (= Kaslian) Stream fish identified as *Alburnoides* sp. (= *A. tabarestanensis*) had a mean absolute fecundity of 1,772.9 eggs, individual fecundity was 668-3,042 eggs, a gonadosomatic index of 6.88 indicated sexual maturity in females and egg diameters (up to 1.67 mm) indicated spawning once a year in June-July, and the highest peak of relative condition was 0.126 during June.

Parasites and predators. The monogenean *Diplozoon paradoxum* was recorded from *A. bipunctatu*s (= *A. tabarestanensis* here and below) in the Tajan River, Mazandaran (*Iranian Fisheries Research and Training Organization Newsletter*, 6:7, 1994). Shamsi *et al*. (1997) reported *Clinostomum complanatum*, a parasite causing laryngo-pharyngitis in humans, from *Alburnoides bipunctatus* in the Shirud. Halimi *et al*. (2013) reported on the cestode *Ligula intestinalis* in *Alburnoides bipunctatus* in Iran without specifying a locality (but the authors were from Babol institutions and so presumably *A. tabarestanensis*). Serum samples from infested fish showed a polymorphism band which indicated a different immune response from that reported for *Rutilus rutilus* (= *R. lacustris*). Youssefi *et al*. (2012) investigated the electrophoretic pattern of somatic and excretory-secretory proteins of the cestode *Ligula intestinalis* in fish identified as

A. bipunctatus, presumably *A. tabarestanensis* as authors were from the Islamic Azad University in Babol. Ahmadiara *et al*. (2013) described the rate of infection of the cestode *Ligula intestinalis* in fish identified as *A. bipunctatus* from Ramsar. Hosseinifard *et al*. (2014) recorded *Dactylogyrus*, *Diplozoon*, *Bothriocephalus* and various nematodes from *A. bipunctatus* in the Garmrud at Amol, Mazandaran. Mazaheri Kohanestani *et al*. (2014, 2014) recorded the digenean *Posthodiplostomum cuticola* in fish identified as *A. eichwaldii* (= *A. tabarestanensis* here and below) from the Zarrin Gol Stream in Golestan Province. Rahmati-holasoo *et al*. (2014) also recorded metacercariae of the digenean *Posthodiplostomum* in fish identified as *A. eichwaldii* from the Zarrin Gol Stream. The average number of cysts was 3.29, with more cysts higher on the body. Shokrolahi *et al*. (2014) recorded *Bothriocephalus gowkongensis* (cestode), *Paradiplozoon* sp. (monogenean) and *Rhabdocona* sp. (nematode) from fish in the Alborz Dam on the Babol River identified as *Alburnoides bipunctatus*. Other parasites were mentioned but not assigned specifically to this species. Taheri Mirghaed *et al*. (2017) recorded parasites from fish in the Alborz Dam and Babol River in Mazandaran, namely *Ichthyophthirius multifilis* (dam and river) (Ciliophora), *Dactylogyrus chalcalburni* (river), *Gyrodactylus prostae* (river) and *Paradiplozoon homoion* (dam and river) (Monogenea), *Bothriocephalus opsariichthydis* (dam and river) and *Ligula intestinalis* (dam) (Digenea). Barzegar *et al*. (2018) reported the monogeneans *Gyrodactylus prostae* and *G. varicorhini* from fish identified as *A. bipunctatus* from the Tajan and Talar rivers and the Talar River, respectively, in Mazandaran.

Economic importance. None.

Experimental studies. Gholipour Kanani *et al*. (2013) found an LC_{50} for glyphosate was 28.65 for *Alburnoides* sp., showing a high sensitivity (authors worked at Gonbad-e Kavus, Golestan so the species was probably *A. tabarestanensis*).Vajargah *et al*. (2013) found that larvae were more sensitive to pesticides than fingerlings of fish identified as *A. bipunctatus* (presumably *A. tabarestanensis* because the researchers were from Gorgan University, Golestan) and LC_{50} values indicated that deltamethrin was more toxic than diazinon.

Conservation. Jouladeh-Roudbar *et al*. (2020) listed it as of Least Concern for its relatively wide distribution range and very abundant populations.

Sources. Mousavi-Sabet *et al*. (2015).

Iranian material:- CMNFI 1970-0533, 29, 33.5-82.1 mm standard length, Mazandaran, Chalus River (ca. 36º39'N, ca. 51º25'E); CMNFI 1979-0429, 3, 25.0-43.7 mm standard length, Mazandaran, Chalus River (36º34'N, 51º23'E); CMNFI 1979-0483, 2, 93.0-98.6 mm standard length, Golestan, Cheshmeh River (37º23'30"N, 55º51'30"E); CMNFI 1979-0493, 11, 51.1-82.8 mm standard length, Mazandaran, stream in Tajan River drainage (36º19'N, 53º23'E); CMNFI 1991-0158, 1, 82.4 mm standard length, Golestan, Madar Su (37º23'N, 55º47'E); CMNFI 1991-0160, 3, 68.2-75.3 mm standard length, Golestan, Abgeer-e Avaness (37º03'N, 54º47'E); CMNFI 1993-0139, 2, 73.9-74.1 mm standard length, Golestan, Dogh River (37º23'30"N, 55º47'E).

Genus *Alburnus*
Rafinesque, 1820

The bleaks and shemayas are found in Europe and the northern parts of Southwest Asia with about 43 species (depending on definitions of the taxa). There are eight to nine species in Iran, mapped by Mohammadian-kalat *et al*. (2015). Records of *Alburnus orontis* Sauvage, 1882 from Iran by Armantrout (1969), Banarescu (1977) and Wossughi (1978) are in error (Krupp, 1985c).

Chalcalburnus Berg, 1933 is now regarded as a synonym of *Alburnus* Rafinesque, 1820

and was used for several Iranian species in older literature. There have been numerous variant views of this synonymy. Bogutskaya (1990) considered *Chalcalburnus* as distinct but later (Bogutskaya 1997; Bogutskaya *et al*., 2000; Bogutskaya and Naseka, 2004) synonymised it with *Alburnus*. Reshetnikov *et al*. (1997) retained *Chalcalburnus* as a distinct genus as did *Catalog of Fishes* (downloaded, 10 August 2007) but was later synonymised (downloaded, 16 September 2015). Banister (1980) pointed out that the distinction of the genus from *Alburnus* is based on the relative lengths of the ventral keel and the relative thickness of the last dorsal fin unbranched ray, characters which he viewed with suspicion in the absence of other corroborating evidence. Mangit and Yerli (2018) in their analysis of Turkish *Alburnus* species found the genus to be paraphyletic with three lineages, *A. filippii* occurring in Iran (along with non-Iranian species) formed one lineage *Alburnus sensu stricto*, and the two other lineages should be excluded. One excluded lineage included *A. sellal* and the other *A. caeruleus* of Iranian relevance. They noted the two lineages may include more than one genus and did not therefore erect new genera for the two lineages. *A. chalcoides aralensis* was listed in the online data as a synonym of *A. filippii* (they had no data for *A. chalcoides* from the Caspian Sea). *A. mossulensis* was confirmed as a synonym of *A. sellal* and they lacked data for other species found in Iran.

This genus is characterised by an elongate, compressed, moderately deep body of small to moderate size, a terminal mouth, no barbels, scales of moderate size, pharyngeal teeth in two rows (2,5-5,2 or 2,5-4,2) with hooked tips and usually serrations (but serrations can be absent), short dorsal fin without a thickened ray, a relatively long anal fin, long and relatively numerous gill rakers, a fleshy keel between the base of the pelvic fins and the vent (the naked part usually not reaching as far forward as the pelvic fin bases in species formerly placed in *Chalcalburnus*), and a light to brown or black peritoneum. Some authors considered the genus *Alburnoides* to be a synonym of *Alburnus* (e.g., Saadati (1977)) while others disagreed (e.g., Bogutskaya (1990)). These two genera are treated separately here to accord with common usage in Southwest Asia, a conservative measure when there are conflicting opinions.

Saadati (1977) referred to an unknown species of *Alburnus* from the Qom River but this material was lost. Also, an unknown *Alburnus* from the Lake Urmia basin was probably *A. ulanus*.

Schönhurth *et al*. (2018) noted that fish identified as *Alburnus mossulensis* (and presumably these would be *A. sellal*, see above) were the sister group to *Acanthobrama*.

Khataminejad *et al*. (2013) distinguished *Alburnus* species in Iran based on morphometrics, *A. hohenackeri* and *A. caeruleus* having a greater body depth and shorter caudal peduncle than others. Khataminejad *et al*. (2015, 2015b) partly distinguished the five species *atropatenae*, *chalcoides*, *filippii*, *hohenackeri* and *mossulensis* (= *A. sellal*) from the Miriseh, Babol, Baleqlu, Mahabad and Gamasiab rivers morphometrically using truss network analysis.

Mohammadian-kalat *et al*. (2013) considered the genus to be taxonomically problematical in Iran with Zagros Mountain populations and widely distributed species such as *A. chalcoides* needing revision.

Jalali *et al*. (2002) and Jalali and Barzegar (2006) recorded several parasites from an undescribed "*Chalcalburnus*" species in Lake Zaribar, namely *Ichthyophthirius multifilis*, two species of *Argulus*, a *Trichodina* species, *Dactylogyrus alatus*, *Diplostomum spathaceum*, *Myxobolus molnari* and *Ligula intestinalis*. Masoumian *et al*. (2007) recorded the myxosporean parasite *Myxobolus saidovi* from *Alburnus maculatus* (*sic*) in the Zayandeh River and Mehdipoor *et al*. (2004) recorded the monogenean *Dactylogyrus alatus* from *Alburnus maculatus* (*sic*), also in the Zayandeh River. These "*Alburnus maculatus*" were probably *A. doriae*. Barzegar *et al*.

(2008) recorded eye parasites from fish identified as *Alburnus alburnus* from the Chaghakhour (= Chagha Khur) and Gandoman lagoons of the Tigris River basin including the digeneans *Diplostomum spathaceum* and *Tylodelphys clavata.* The identity of these fish is uncertain as they could possibly be *A. doriae* or transplanted *A. hohenackeri*. Rahimi *et al*. (2016) described the prevalence and antimicrobial resistance of *Listeria* species in *Alburnus* species from retail stores in Esfahan and Bandar Anzali. There was a potential risk of infection for people consuming raw or under cooked smoked and salted fish.

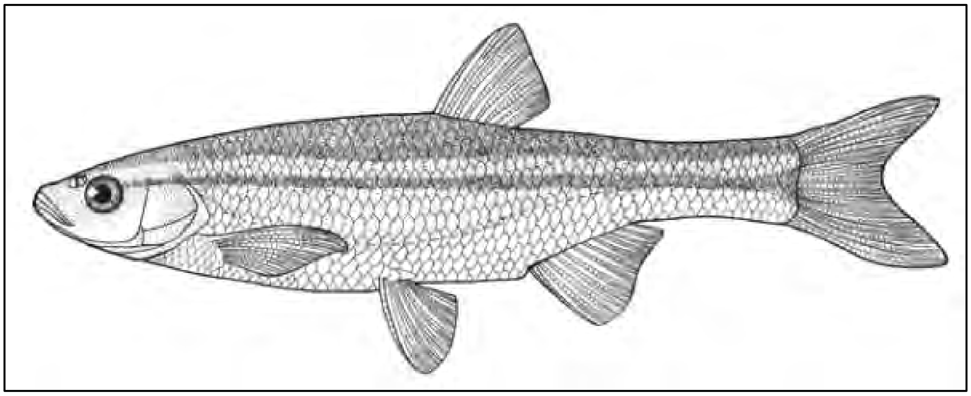
Esmaeili *et al*. (2018) tested the impact of climate change on members of this genus in Iran, finding that basins along the Elburz and Zagros mountains had the highest climatic suitability with precipitation playing a more important role than temperature. All species were likely to be affected negatively in the future and a comprehensive management plan is needed. Yousefi *et al*. (2019) reviewed recent studies on climate change which is now a major problem for many organisms in Iran, including fishes.

Small fishes and members of the genus *Alburnus* are called kuli in Farsi or Gilaki. Kuli may derive from kul which can mean any pond or sheet of water. In Gilan, kuli are eaten with their heads on and are said to full of phosphorus, conferring open-mindedness, intelligence and sophistication on the Gilanis.

The following table summarises some key distinguishing characters of the Iranian species of *Alburnus*.

Species/ Character	Modal dorsal fin branched rays	Anal fin branched rays	Total gill rakers	Lateral line scales	Peritoneum colour	Flank stripe	Distribution by basin
Al. atropatenae	8	9-12	11-16	46-63	black	+	Lake Urmia
Al. caeruleus	8	13-18	10-13	43-58	brown to black	+ -	Tigris River
Al. chalcoides	8	10-21 (mostly 14-15)	18-31 (mostly 20-23)	54-74 (mostly 57-63)	light brown	-	Caspian Sea
Al. doriae	8	9-12	12-18	44-59	silvery	+	Esfahan, Namak Lake, Tigris River
Al. filippii	7	9-13 (mostly 10-12)	12-21 (mostly 12-17)	46-64 (often 57 or less)	light brown	+	Caspian Sea
Al. hohenackeri	8	10-16	19-25	34-55 (often 45 or less)	light silvery	+ or -	Caspian Sea
Al. sellal	8	9-14	8-18 (mostly 11-16)	58-89 (often 62 or more)	brown to black	+	Hormoz, Kor River, Lake Maharlu, Persis, Tigris River
Al. taeniatus	8	9-13 (mostly 10-12)	13-23 (lower counts suspect)	30-46	-	+	Hari River
Al. ulanus	8	7-11 (mostly 8-9)	12-16	35-45	silvery-brown	+	Lake Urmia

Alburnus atropatenae
Berg, 1925



Alburnus atropatenae,
Susan Laurie-Bourque @ Canadian Museum of Nature.

Alburnus atropatenae, East Azarbayjan, Ghalechai (= Qal'eh River), Lake Urmia basin, October 2011, Keyvan Abbasi.

Common names. Shah kuli-ye Orumiyeh (= Urmia king fish).

[Urmia or Urmian bleak, Urmia or Urmian Lake bleak, Urmia kingfish (Moshaeidi *et al*., 2014), Urmia shemaya].

Systematics. The type series is the material called *Alburnus filippii* by Günther (1899) from "Sujbulak and Superghan near the mouth of the Nazlu Chai" as noted in Berg (1925). This material is in the Natural History Museum, London under BM(NH) 1899.9.30:127, syntype, 89.7 mm standard length, West Azarbayjan, Superghan near the mouth of the Nazlu Chai (Sopurghan on the Nazlu Chay is at 37°45'N, 45°12'E) and BM(NH) 1899.9.30:128-30, syntypes, 3, 70.7-96.3 mm standard length, West Azarbayjan, Tatawa Chai near Sujbulak (the Tata'u Chay or Simineh River is not close to Saujbulagh or Mahabad at 36°45'N, 45°43'E so the exact locality of this collection is unclear). These syntypes bear an external label, apparently in A. Günther's handwriting, listing these fish under the name "brevianalis" which is crossed out and *filippii* substituted. It appears that Günther originally intended to describe them as distinct and subsequently changed his mind.

Alburnus atropatenae, syntype, BM(NH) 1899.9.30:127.

Alburnus atropatenae, syntype, BM(NH) 1899.9.30:128-130.

Berg's (1925) material was not found in a search of the collections of the Zoological Institute, St. Petersburg (ZISP) in November 1993. Eschmeyer *et al*. (1996) gave the following data:- Syntypes (46) ZIL (ZIL being the old acronym for ZISP) but this material is presumably comparative specimens mentioned by Berg (1925).

Coad and Holčík (1999) demonstrated variation between three populations, eastern, western and southern, isolated by the salt Lake Urmia but considered this variation as insufficiently different to warrant taxonomic distinction. Nonetheless, the analysis demonstrated that the three populations have diverged in a measurable manner, presumably through geographical isolation, although ecological factors may have played a part as one sample was from a lacustrine rather than a riverine environment. Moshaeidi *et al*. (2014) morphometrically distinguished fish of the Zarrineh River from those of the Baneh, Saghez (= Saqqez) and Simineh rivers combined, the latter having a smaller head size and caudal peduncle for example. Mohammadian-kalat *et al*. (2015) were also able to discriminate populations (in five rivers) with morphometric characters more reliable than meristic ones. Radkhah *et al*. (2016) found fish from the Simineh and Zarrineh rivers had significant differences in such morphometric characters as prepelvic distance and body depth and that depth and water flow rate had the highest influence on morphology. Tajik and Keivany (2015a) compared fish from the Baranduz and Nazlu rivers finding that the latter had longer heads, wider caudal peduncles and a higher location for the anal fin position. Keivany (2017, 2018) and Tajik and Keivany (2018) studied 274 specimens from the Aghdarreh, Baranduz, Nazlu, Sarough, Senteh, Talkheh (= Aji) and Zarrineh rivers for 17 morphometric and 17 meristic traits, finding various differences between populations and groups of populations, e.g., the Talkheh population was separate to some extent from the others morphometrically, and the Nazlu populations were completely separate from the Senteh and Zarrineh populations, and there were no differences between the Baranduz and Talkheh, Baranduz and Nazlu, and Senteh and Zarrineh. Eagderi *et al*. (2019) compared 163 fish morphometrically from the Baneh, Saghez (= Saqqez), Simineh and Zarrineh rivers and found the latter three clustered together, the Baneh, Saghez (= Saqqez) and Simineh populations had a deeper body and were distinguishable by a smaller head, posterior eye position and shorter anal fin base respectively, and the Zarrineh population was distinguishable by a more fusiform body and less body depth. These differences were attributed to ongoing evolutionary trends as a result

of differing environmental conditions and isolation.

Key characters. This species is distinguished by having modally 8 branched dorsal fin rays, 11-16 total gill rakers, 46-63 lateral line scales 46-63, a black peritoneum, and a distribution in the Lake Urmia basin.

Morphology. The body is rounded and moderately deep, being deepest at a level between the end of the pectoral fin and the pelvic fin origin. A slight nuchal hump is present in some fish. The predorsal profile is straight in front of the dorsal fin and then convex leading down to the head, or a continuous convex curve. The caudal peduncle is slightly compressed but quite rounded and is moderately deep. The snout is rounded. The rear of the eye is at the beginning of the anterior half of the head. The mouth is terminal and oblique and extends back level with the nostril. The lower jaw is rounded and may protrude slightly. Lips are thin with the centre of the upper lip thickest. The dorsal fin margin is straight. The dorsal fin origin is well posterior to the level of the pelvic fin origin and is over the depressed mid-fin or further back. The depressed dorsal fin extends back level with middle of the anal fin. The caudal fin is shallowly forked and tips are rounded. The anal fin is rounded and is remote from the caudal fin base. The pelvic fin is rounded and does not reach back to the anus but may reach the anterior anal papilla in some fish. The pectoral fin is rounded and does not extend back to the pelvic fin origin.

Dorsal fin with 3 unbranched rays and 7-9, modally 8, branched rays, anal fin with 3 unbranched rays and 9-12 branched rays, pectoral fin branched rays 13-16, and pelvic fin branched rays 7-8. Lateral line scales 46-63. There is a pelvic axillary scale. Scale shape is a vertical oval or somewhat more squarish. All margins are rounded and there are no abrupt anterior corners in some while others have distinct but rounded corners. The anterior margin has a central protrusion with an indentation above and below, or the protrusion lacks obvious adjacent indentations, or the margin is wavy. The scale focus is slightly anterior or central and there are relatively few anterior and posterior radii about equal in number. The exposed fleshy keel in front of the anus is about 1-4 scales lengths, usually 2, long. Gill rakers are lanceolate but short, less than half eye width, reaching between the first and second adjacent rakers or touching the second when appressed, total rakers being 11-16. Pharyngeal teeth are hooked at the tip and usually bear a few, large serrations on the larger major row teeth or more rarely have no serrations, apparently size independent. The posteriormost major row tooth may be dorsal rather than posterior to the tooth ahead of it. Tooth counts are usually 2,5-4,2. The gut is an elongate s-shape, sometimes with an anterior loop to the left. Total vertebrae 41-43. Chromosome number is 2n = 50 (Nazari *et al*., 2011).

Meristic values are:- dorsal fin branched rays 7(2), 8(102) or 9(1), anal fin branched rays 9(5), 10(49), 11(45) or 12(6), pectoral fin branched rays 13(7), 14(44), 15(41) or 16(13), pelvic fin branched rays 7(17) or 8(88), lateral line scales 46(4), 47(5), 48(12), 49(15), 50(13), 51(15), 52(14), 53(5), 54(5), 55(5), 56(2), 57(-), 58(6), 59(-), 60(-), 61(-), 62(-) or 63(1), total gill rakers 11(12), 12(30), 13(35), 14(16), 15(7) or 16(2), pharyngeal teeth 2,5-4,2(54), 2,4-4,2(2), 2,4-5,2(1), 2,5-5,2(1), 1,5-4,2(1) or 2,5-3,2(1), and total vertebrae 41(4), 42(12) or 43(3). Meristic counts by Khataminejad *et al*. (2015) for fish from the Miriseh River fall within the ranges above.

Sexual dimorphism. Male specimens have small scattered tubercles on the top of the head with fewer tubercles on the side of the head. Tubercles are variably distributed on the head depending on the specimen, or even be different on each side of a single fish. A distinct row may parallel the upper lip, another row may follow the upper eye margin, a patch may be present

between the nostril and the upper lip, and there may be tubercles between the mouth and the eye. Very small tubercles line the scale margins on the back, flank and belly, and belly scales have a fine row of tubercles on the scale base. Tubercles line the rays of the pectoral, dorsal, pelvic and anal fins and weakly on the caudal fin, the rows branching with the fin rays.

Colour. The back is a dark olive brown to grey, with a narrow stripe. The flank has a dark stripe, as wide as the pupil of the eye or narrower at its maximum width, extending onto the head as far as the eye and back to the middle of the caudal fin. The stripe is black to dark green. The flank above the stripe is often lighter in contrast to the darker back and accentuates the distinctiveness of the stripe. The flank below this stripe, the belly and the lower head are silvery, and the stripe is clearly set off from the lower flank. The front of the lower jaw is dark and some of this pigment extends into the floor of the mouth. The iris is silvery on the lower half and dark above. The dorsal fin is faintly pigmented grey along its rays, the caudal fin is grey and the other fins are colourless. Melanophores are present on the dorsal and caudal fin rays and the anterior rays of the pectoral, pelvic and anal fin rays. The nostrils may be dark. The peritoneum is black.

Size. Reaches 21.8 cm.

Distribution. This species is endemic to the Lake Urmia basin and is recorded from the Aghdarreh, Balanoosh, Baneh, Baranduz, Bitas, Chamalton, Chamsaqez (= Saqqez), Cheagia, Ghale (= Qal'eh), Godar, Haladj, Hasanlu, Kazim, Koter, Mahabad, Mardogh, Miriseh, Nazlu, Ozband, Qader, Qasemlu, Qonbad, Rozeh, Saghez (= Saqqez), Sarough, Senteh, Shahr, Simineh, Sufi, Talkheh (= Aji) and Zarrineh rivers, the Ghaleh (= Qaleh) and Guru (= Guru Gowl) lakes, and the Cheragveis, Hasanlu and Mahabad dams (Günther, 1899; Berg, 1925; Abdoli, 2000; Mirhasheminasab and Pazooki, 2003; Abbasi *et al*., 2005; K. Abbasi, pers. comm., 2012; Banan Khojasteh *et al*., 2012; Khataminejad *et al*., 2013, 2015, 2015; Moradi and Eagderi, 2014; Moshaeidi *et al*., 2014; Mousavi-Sabet *et al*., 2014; Ghasemi *et al*., 2015; Tajik and Keivany, 2015a; Dadai Ghandi *et al*., 2017; Eagderi and Moradi, 2017; Mohammadian-Kalat *et al*., 2017; Eagderi *et al*., 2019; Fathi and Ahmadifard, 2019; Kaya, 2020; Mouludi-Saleh *et al*., 2021).

Khataminejad *et al*. (2013) recorded it from the Quareh-Chay (= Qareh Chay) of the Namak Lake basin at 34°53'.250"N, 50°022'51"E. These fish were later described as a new species, *A. amirkabiri* Mousavi-Sabet *et al*. (2015) but are *A. doriae* according to Mohammadian-Kalat *et al*. (2017).

Zoogeography. Lake Urmia was formed during the late Pliocene-Pleistocene, lies at 1,275-1,295 m, and may well have had a Pleistocene connection to the Caspian Sea basin although this has been disputed (Scharlu, 1968; Schweizer, 1975). Pleistocene shorelines from 30 to 115 m above the present level have been confirmed, and the lake covered twice its present area, but this would not permit an external discharge. Berg (1940) reported benches at levels of about 1,800 m, 1,650-1,550 m and 1,500-1,360 m, which may represent shorelines, and a level of about 1,570 m would have had an outlet to the Aras River basin through the Kara-tepe Pass in the northwest and across the plain near the city of Khvoy. Saadati (1977) suggested two connections with the Caspian Sea, an early one in the Pliocene to early Pleistocene resulting in endemic species and a later one in the late Pleistocene resulting in species which are the same as the Caspian or only subspecifically distinct. *A. atropatenae* may have its origin in the earlier transgression.

Habitat. This species is found in rivers, streams, lakes and dams. Abbasi *et al*. (2005) stated this is the second most abundant fish species in the Mahabad River of the Lake Urmia basin. Collection data were 16.5-27°C, sand and pebble bottoms, still to fast water, and the shore grassy or bushy. The photograph below shows habitat alteration.

Habitat of *Alburnus atropatenae*, West Azarbayjan, Gadar (= Qader) River, Hamid Reza Esmaeili.

Age and growth. Esmaeili *et al*. (2014) gave a *b* value for 36 fish, 8.0-12.0 cm total length, from Lake Urmia as 3.18. Mousavi-Sabet *et al*. (2014) gave a *b* value of 3.313 for 30 fish, 7.55-9.74 cm total length, from the Mahabad River. Radkhah and Eagderi (2015a) gave a *b* value for 40 fish from the Zarrineh River, 7.6-12.5 cm total length, as 3.26, positive allometric growth. Condition factor was 1.021. Tajik and Keivany (2015b) also examined fish from the Zarrineh River (59, 4.43-12.82 cm total length) and found a length-weight relationship of $W = 0.0111TL^{2.89}$ indicating in contrast negative allometric growth. Keivany and Zamani-Faradonbeh (2016) gave a *b* value of 2.73 for 39 fish, 3.14-6.51 cm total length, from the Talkheh (= Aji) River. Mouludi-Saleh *et al*. (2021) examined 180 fish, 3.92-19.6 cm total length, from the Ghale (= Qaleh), Godar and Mahabad rivers and recorded a *b* value of 3.38, positive allometric, and a condition factor of 0.95.

Food. Gut contents are insects, crustaceans and worms. Filamentous algae are also present, possibly as accidental inclusions.

Reproduction. A fish captured 25-26 June 1962 (115.7 mm standard length, CMNFI 1979-0785) carried mature eggs.

Parasites and predators. None reported.

Economic importance. Unknown.

Experimental studies. None.

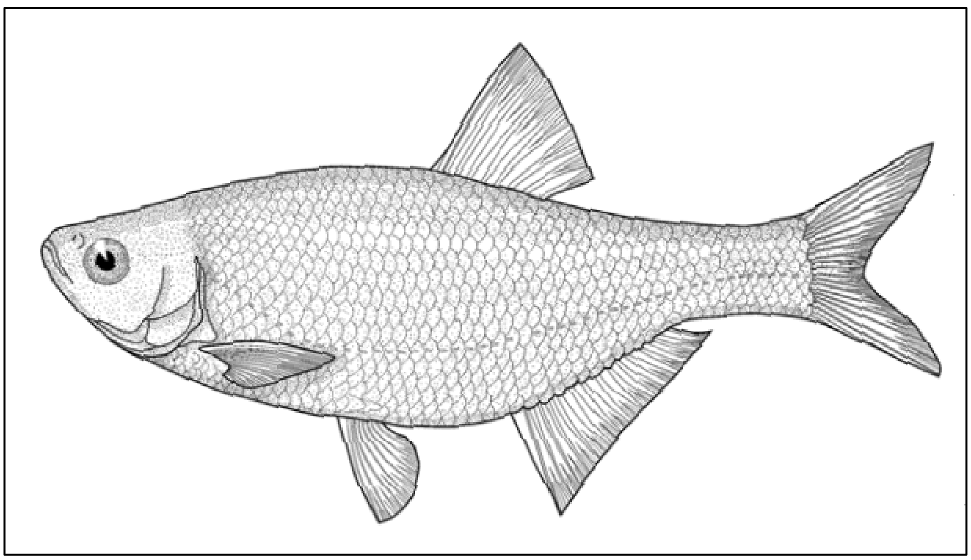
Conservation. Biology is poorly known and numbers and habitat requirements would have to be examined for a conservation assessment.

Sources. Type material:- *Alburnus atropatenae* (BM(NH) 1899.9.30:127 and BM(NH) 1899.9.30:128-30).

Iranian material:- CMNFI 1970-0557, 26, 17.9-31.6 mm standard length, West Azarbayjan, Shahr Chay (ca. 37º27'N, ca. 44º55'E); CMNFI 1970-0558, 8, 25.0-88.7 mm standard length, West Azarbayjan, Qasemlu Chay (ca. 37º21'N, ca. 45º09'E); CMNFI 1970-0559, 48, 31.4-85.2 mm standard length, West Azarbayjan, Baranduz Chay (37º25'N, 45º10'E);

CMNFI 1970-0561, 3, not kept, possibly West Azarbayjan, Cheagia Chay (no other locality data, possibly Ghaie Chay); CMNFI 1979-0785, 11, 72.6-123.8 mm standard length, West Azarbayjan, Shahr Chay (ca. 37º27'N, ca. 44º55'E); CMNFI 1979-0786, 26, 65.0-92.2 mm standard length, East Azarbayjan, Guru Lake (37º55'N, 46º24'E); CMNFI 2007-0096, 1, 54.7 mm standard length, West Azarbayjan, Qasemlu River in Baranduz Chay basin (ca. 37º25'N, ca. 45º10'E); CMNFI 2007-0097, 2, 42.0-54.9 mm standard length, West Azarbayjan, Baranduz Chay basin (ca. 37º16'N, ca. 45º08'E); CMNFI 2007-0103, 6, 43.3-73.3 mm standard length, Kordestan, Zarrineh River basin north of Saqqez (ca. 36º18'N, ca. 46º16'E); CMNFI 2007-0104, not kept, Kordestan, Zarrineh River basin south of Saqqez (ca. 36º12'N, ca. 46º18'E); CMNFI 2007-0105, 6, 67.3-112.1 mm standard length, Kordestan, Zarrineh River basin (ca. 36º06'N, ca. 46º20'E); CMNFI 2008-0137, 2, 72.2-80.9 mm standard length, West Azarbayjan, Zarrineh River (37º05'N, 45º44'E); CMNFI 2008-0158, 1, 88.8 mm standard length, Lake Urmia basin (no other locality data); OSU 8122, 2, 73.1-83.5 mm standard length, West Azarbayjan, Shahr Chay (ca. 37º27'N, ca. 44º55'E); USNM 205904, 2, 73.0-82.6 mm standard length, West Azarbayjan, Nazlu Chay (37º40'N, 45º05'E); uncatalogued, 1, 81.6 mm standard length, West Azarbayjan, Haladj River near Mahabad (ca. 36º45'N, ca. 45º43'E) (Coad and Holčík, 1999).

Alburnus caeruleus
Heckel, 1843



Alburnus caeruleus
Susan Laurie-Bourque @ Canadian Museum of Nature.

Alburnus caeruleus, Iran, Gamasiab River, July 2008, Keyvan Abbasi.

Alburnus caeruleus, Khuzestan, Sabzab, Andimeshk, Hamid Reza Esmaeili.

Alburnus caeruleus, Turkey, Tigris River, Diyarbakır, Jörg Freyhof.

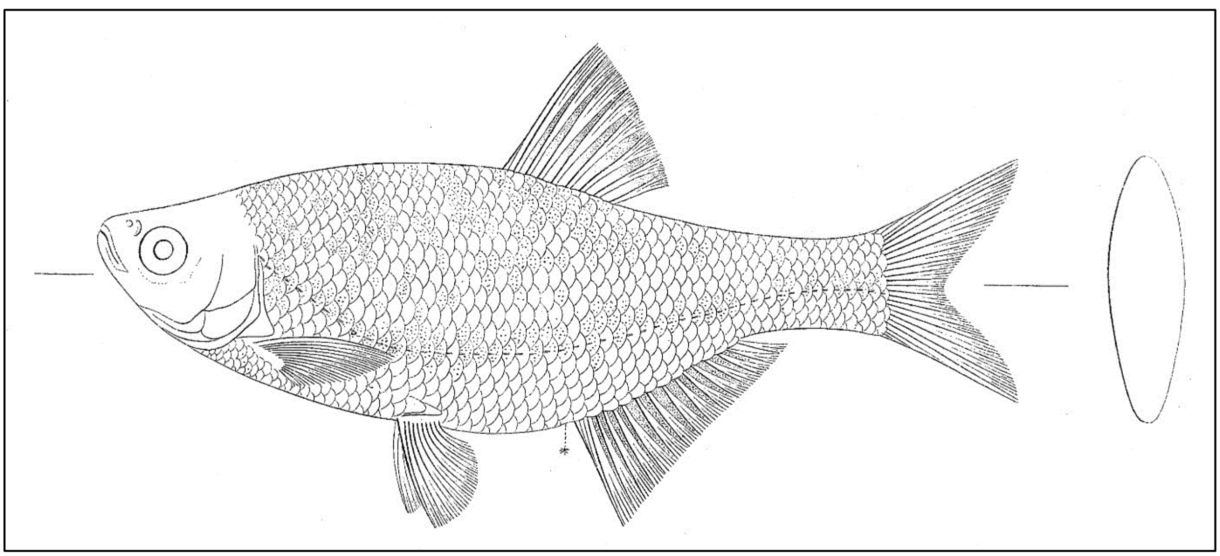
Alburnus caeruleus, 9.0 cm, Iraq, Irbil
(CC BY 3.0, cropped and lightened, Haider Ibrahem al Timimi).

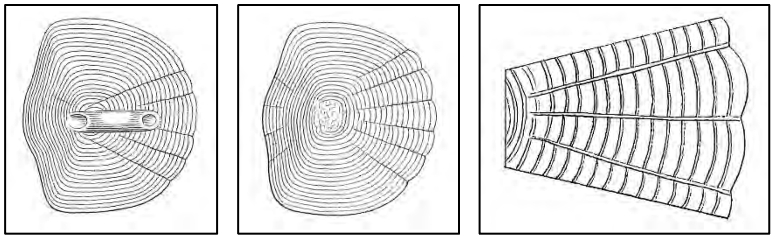
Alburnus caeruleus, Turkey, Euphrates River basin, Adıyaman, Jörg Freyhof.

Common names. Kuli-ye Dejleh (= Tigris fish), morvarid mahi khaldar (= spotted pearl fish).

[Lassafa (= fluorescent, from Mikaili and Shayegh (2011); taffaf (= little worm) or teffaf asrak (= little blue worm) at Aleppo (= Halab, Syria) in Heckel (1843b); İnci balığı in Turkish (Kaya *et al*., 2016); black spotted bleak, Tigris bleak].

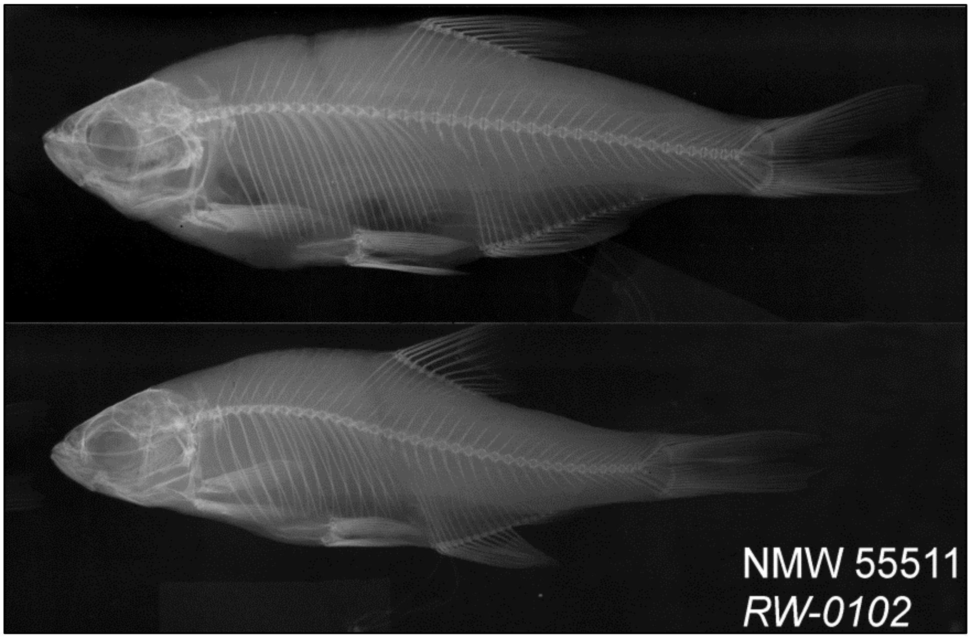
Systematics. The type locality is Aleppo (= Halab), Syria and material is held in the Naturhistorisches Museum Wien. Syntypes are listed in Eschmeyer *et al*. (1996) as NMW 16688 (4, 65.7-86.6 mm standard length as measured by me), NMW 55511-13 (2, 64.5-75.4 mm standard length, 2, 61.2-71.1 mm standard length, 2, 74.1-77.4 mm standard length), NMW 57161 (3, 59.6-71.1 mm standard length), and additionally possibly RMNH 2656 (Rijksmuseum van Natuurlijke Historie, Leiden, ex NMW, 4), and SMF 100 (Senckenberg Museum Frankfurt, ex NMW, 4, 61.3-75.7 mm standard length). B. Riedel (pers. comm., 11 April 2019) also listed NMW 79191 as a syntype (dry bone, *sic*, probably a dried or stuffed specimen in this case).





Alburnus caeruleus,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line (regenerated), and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus caeruleus, syntypes, NMW 55511, Naturhistorisches Museum, Wien.



Alburnus caeruleus, syntypes, NMW 55511, Naturhistorisches Museum, Wien.

Alburnoides recepi Turan, Kaya, Ekmekçi and Doğan, 2014 described from the Merzimen Stream in the Turkish Euphrates River drainage is a synonym (Birecikligil *et al*. 2017).

Dorafshan *et al*. (2014) found a high level of polymorphism although there was more interspecific (94%) than intraspecific (4%) genetic variation compared with *A. mossulensis* (= *A. sellal*).

Key characters. This species is distinguished from its relatives by a combination of the lateral line scale count, anal fin branched ray count and total gill raker count, along with a deep body (2.8-3.5 in standard length).

Morphology. The body is relatively deep, 2.8-3.5 times in standard length, with a slight nuchal hump, or the back is rounded in front of the dorsal fin. Young fish are not as deep as adults. The caudal peduncle is relatively deep. The mouth is oblique and does not reach back to the eye. The dorsal fin has a truncate margin and its origin lies over the pelvic fin, well posterior to the pelvic fin origin. The caudal fin is moderately forked with rounded to pointed tips. The anal fin is long with an obliquely truncate margin (Heckel, 1843b) or the margin is emarginate. The anal fin origin lies almost below the centre of the dorsal fin. The pectoral fin extends back to, or just short of, the pelvic fin origin. The pelvic fin reaches back just short of the anal fin origin.

Dorsal fin with 3 unbranched and 7-10 branched rays, usually 8, anal fin with 3 unbranched and 13-18 branched rays, mostly 14-16, pectoral fin branched rays 11-15, and pelvic fin branched rays 6-8. Lateral line scales 43-58. The lateral line is moderately to strongly decurved, and may be irregular in part. Scale shape is a vertical oval with a rounded posterior margin, short and rounded dorsal and ventral margins, and a rounded central posterior margin with shallow indentations dorsally and ventrally. Scales lack radii on the anterior field or may have a few radii, have few posterior radii (six in fish illustrated above), a sub-central anterior focus, and a moderate number of circuli. The naked ventral keel is obvious. Total gill rakers number 10-13, just reaching past the adjacent raker when appressed. Pharyngeal teeth are hooked

at the tip and deeply notched or serrated below, modally 2,5-4,2, with variants 2,5-5,2, and 2,5-4,1. The gut is s-shaped. Total vertebrae number 38-40. The syntypes NMW 55511 have 40(2), NMW 55512 39(2), NMW 55513 39(2) and NMW 16688 38(1) and 39(3) total vertebrae. Chromosome number is 2n = 50 (Nazari *et al*., 2011).

Sexual dimorphism. Males have tubercles on the lower jaw, the sides and dorsal surface of the head and on flank scales. Tubercles are evident on the pectoral fin and appear as traces on the pelvic fins.

Colour. The back is blackish, with flanks silvery and sometimes overall olive-green. The horizontal stripe along the flank is sky-blue, more diffuse or absent in larger fish but very evident in smaller ones. Flanks, even lower flanks, and head are heavily speckled. The lateral line may bear pigment spots above and below each pore but the stitched effect is not as marked as in some *Alburnoides* species. Fins are generally yellowish, the dorsal, anal and pelvic fins apically black to sky blue. The membranes of the dorsal and anal fins are heavily pigmented while the rays are clearer. This pigmentation is more evident anteriorly on small fish but in both large and small fish fins appear dark, especially when the fins are collapsed. On the anal fin some fish have dark pigment on all membranes, others, even large fish, have less pigmentation distally on the posterior membranes. In larger fish, the pectoral and pelvic fins have dark membranes, the pigmentation fading on the smaller rays. The pectoral and pelvic fins can be orange. In some specimens the edge of the caudal fin is quite dark. The peritoneum is brown to black.

Size. Attains 13.0 cm total length (Saç, 2020).

Distribution. This species is found in the Tigris-Euphrates and Quwayq River systems. The Orontes (= Asi) River is not a locality (Krupp, 1985c). In Iran, recorded from the Tigris River basin in the Arvand, Dinvar, Do Ab, Chardoval, Gamasiab, Kashkan, Marun, Qareh Su, Sarabeleh (= Sar Ableh) and Simareh rivers (K. Abbasi, *Iranian Fisheries Research Organization Newsletter*, 57:2, 2009; Khataminejad *et al*., 2013; Dorafshan *et al*., 2014; Mousavi-Sabet *et al*., 2015; Zareian *et al*., 2015; Mohammadian-Kalat *et al*., 2017; Khamees *et al*., 2019; Jouladeh-Roudbar *et al*., 2020). It may be more widely distributed in Iran than records suggest.

Zoogeography. The relationships of this species zoogeographically have not been studied.

Habitat. This species is found in rivers, streams, lakes, dams and ponds. In Iran, it was recorded by K. Abbasi (*Iranian Fisheries Research Organization Newsletter*, 57:2, 2009) from the Gamasiab and Do Ab rivers (34º22'16"N, 47º54'51"E at 1,412 m altitude and 34º27'11"N, 47º39'34"E at 1,322 m) and, given the fishing effort, were quite rare (0.02% of fishing sites, eight individuals). Khalifa (1989) reported this species as widely distributed in rivers and ponds, and it is also found in streams, dams and reservoirs in Iraq. Epler *et al*. (2001) found it to be the third most dominant species of fish in the Iraqi lakes Habbaniyah, Tharthar and Razzazah, comprising 8.7% of all fish collected.

Habitat of *Alburnus caeruleus*, Ilam, Chardoval River, Hamid Reza Esmaeili.

Age and growth. Mousavi-Sabet *et al*. (2014) gave a *b* value of 3.072 for 13 fish, 6.61-8.21 cm total length, from the Sarabeleh (= Sar Ableh) River. Valikhani *et al*. (2020) combined fish from the Shadegan Wetland and the Dez and Karkheh rivers and reported a *b* value of 2.84 (isometric growth) and a condition factor of 2.81 for 55 fish, 3.2-8.5 cm total length.

Saç (2020) found *b* values for Euphrates (56 fish, 3.4-6.2 cm total length) and Tigris River (30 fish, 4.3-6.8 cm total length) populations in Turkey were 3.243 and 3.34, both indicating positive allometric growth. Seçer *et al*. (2020) determined the population parameters of this fish in the Merzimen Stream of the Euphrates River basin of Turkey. A total of 347 specimens were analyzed and the age varied from 0 to 3 age classes with the majority at age class 2 (44.45%) followed by the 1, 3 and 0 age classes, respectively. Total length ranged from 2.6 to 8.4 cm and weight varied from 0.11 to 6.82 g. The average length and weight were calculated as 5.53±1.12 cm and 1.83±1.23 g, respectively. The length-weight relationship was $W = 0.0062TL^{3.221}$. The von Bertalanffy growth parameters were $L_\infty = 10.50$ cm, $k = 0.3665$, $t_o = -0.89$, growth coefficient (Φ') = 3.7 and condition factor (K) = 0.37. Total, natural and fishing mortalities rates and exploitation rate were estimated as Z = 0.79, M = 0.55, F = 0.24 and E = 0.30, respectively.

Food. Unknown.

Reproduction. Large eggs were visible in fish from Syria caught on 19 May, suggesting spring spawning.

Parasites and predators. None reported from Iran.

Economic importance. None.

Experimental studies. None.

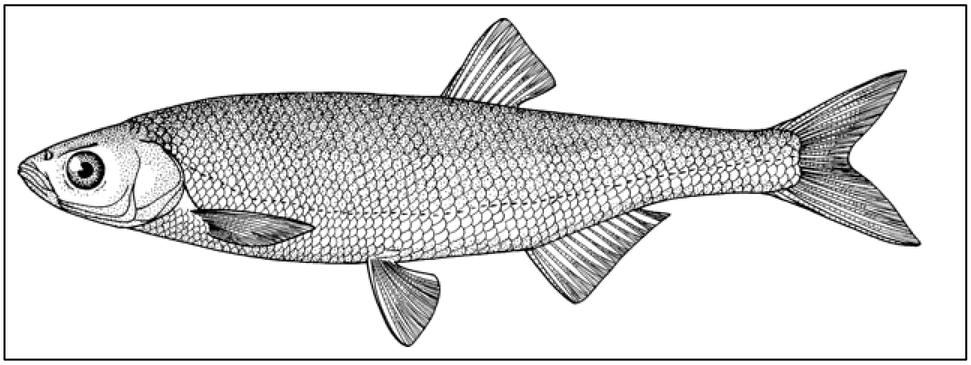
Conservation. This species is poorly known and documented in Iran so its conservation status is unknown. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Type material:- *Alburnus caeruleus* (NMW 16688, NMW 55511, NMW 55512, NMW 55513, NMW 57161 and SMF 100).

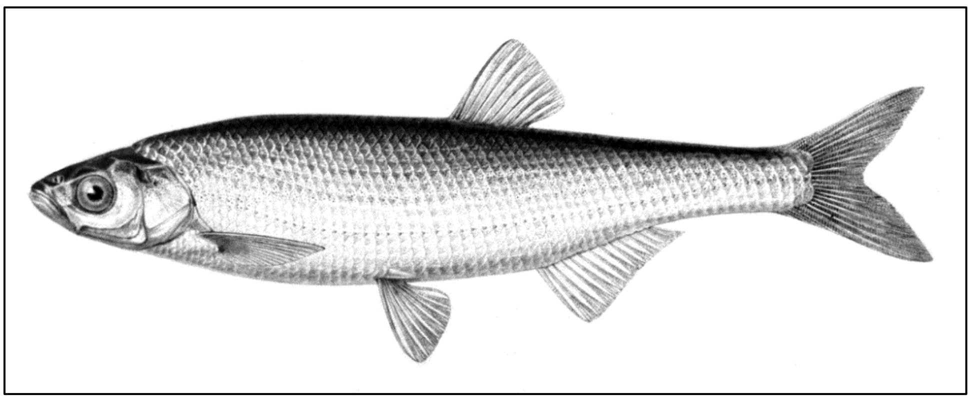
Iranian material: None.

Comparative material:- BM(NH) 1974.2.22:83, 1, 67.9 mm standard length, Iraq, Sirwan, Tigris River near Faish Khabur (ca. 37º08'N, ca. 42º38'E); SMF 28638, 14, 69.1-100.7 mm standard length, Syria, Euphrates River, Deir ez-Zor (35º31'N, 39º54'E); SMF 28678, 3, 59.0-98.8 mm standard length, Syria, Euphrates River upstream Deir ez-Zor (35º31'N, 39º57'E); SMF 28698, 4, 84.4-105.6 mm standard length, Syria, Euphrates River, downstream Baath Lake (35º55.723'N, 39º00.572'E); SMF 28712, 3, 51.8-59.3 mm standard length, Syria, Euphrates River Raqqa to Halebye-Zalebye (35º36.083'N, 39º00.572'E to 53º50.029'N, 39º20.797'E); ZMB 3364 (possibly syntypes as marked from Vienna Museum), 4, 55.6-65.8 mm standard length, Syria, Aleppo (= Halab).

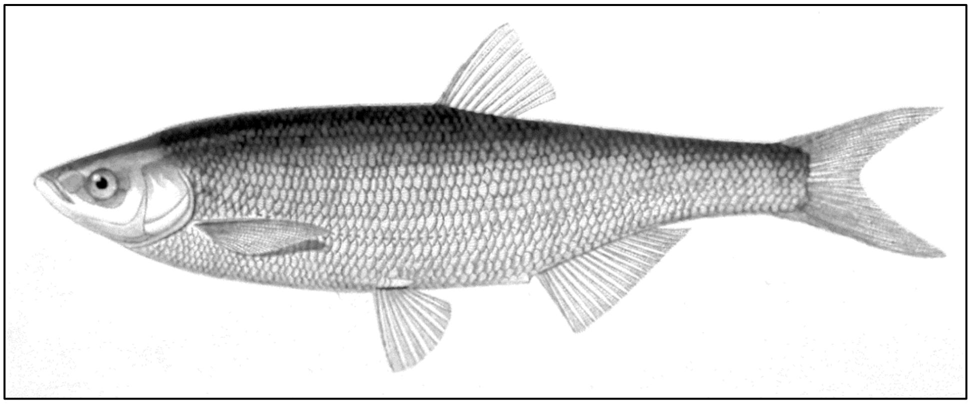
Alburnus chalcoides
(Güldenstädt, 1772)



Alburnus chalcoides
Susan Laurie-Bourque @ Canadian Museum of Nature.



Alburnus chalcoides, 23.0 cm total length, ZISP 10701,
Kazakhstan, Caspian Sea at Fort-Shevchenko, after Berg (1948-1949).



Alburnus chalcoides, ZISP 10793, Russia, Terek River at Shchedrinskaya, after Berg (1948-1949).

Alburnus chalcoides, Gilan, Shalman River, Keyvan Abbasi.

Alburnus chalcoides, Mazandaran, Tajan River, Jörg Freyhof.

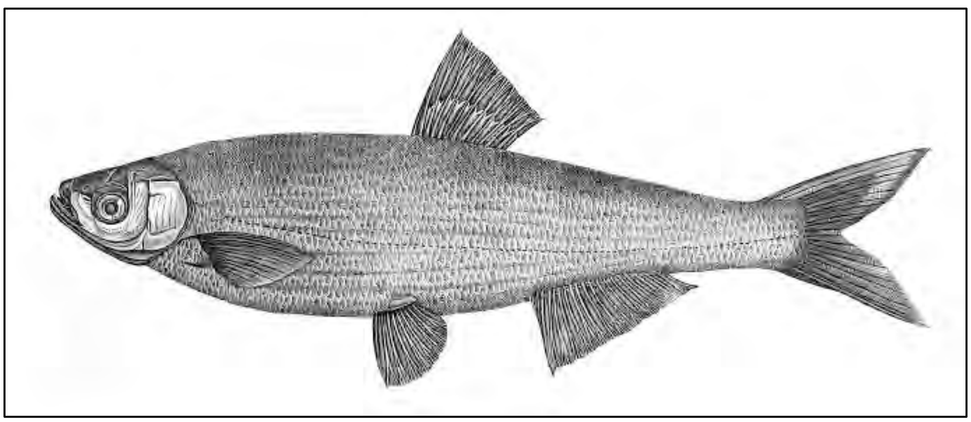
Alburnus chalcoides, Gilan, Shafa River, June 2009, Keyvan Abbasi.

Alburnus chalcoides, Gilan, Shafa River, June 2009, Keyvan Abbasi.

Common names. Aslak in Mazandaran; kas-e kuli (= cup or bowl fish?); kuli, shah kuli or shah kooli, shah mahi in Gilaki (= royal fish or king fish in the sense of the best or most important fish); mahi shah kuli; sefid kuli (= white fish), shahkuli-ye Khazar (= Caspian king fish); siah kole (= presumably siah kuli, black fish).

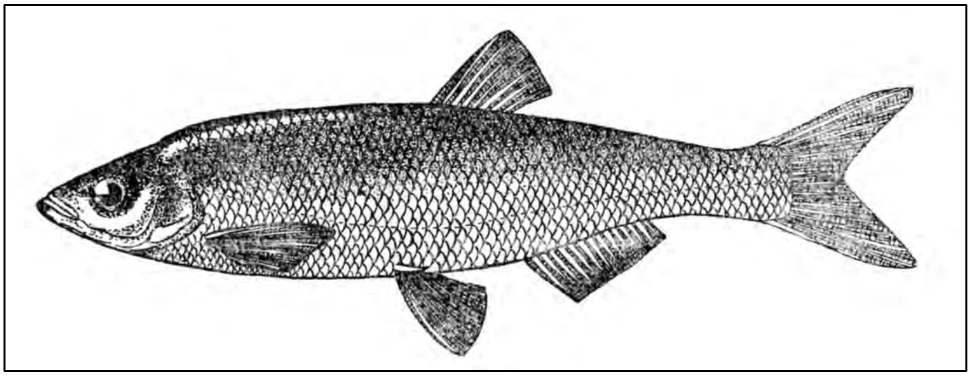
[Samayi, schamay or schumai, Lankaran samayisi for *A. chalcoides longissimus*, Kur samayisi for *A. chalcoides*, all in Azerbaijan; Iranskaya shemaya or Iranian shemaya, Lenkoranskaya shemaya or Lenkoran shemaya, shemaya or shamaya in Russian; bleak, Caspian shemaya, Danube bleak; gypsy king fish (Garedaghi and Mohammadi Hefz Abad, 2012)].

Systematics. *Cyprinus chalcoides* was originally described from the Terek, Sulak and Cyrus (= Kura) rivers, Russia. No types are known.

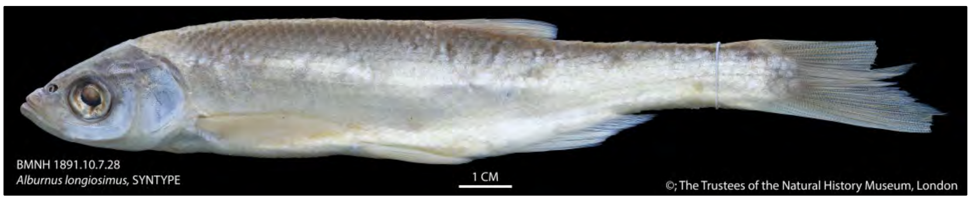


Cyprinus chalcoides, after Güldenstädt (1772).

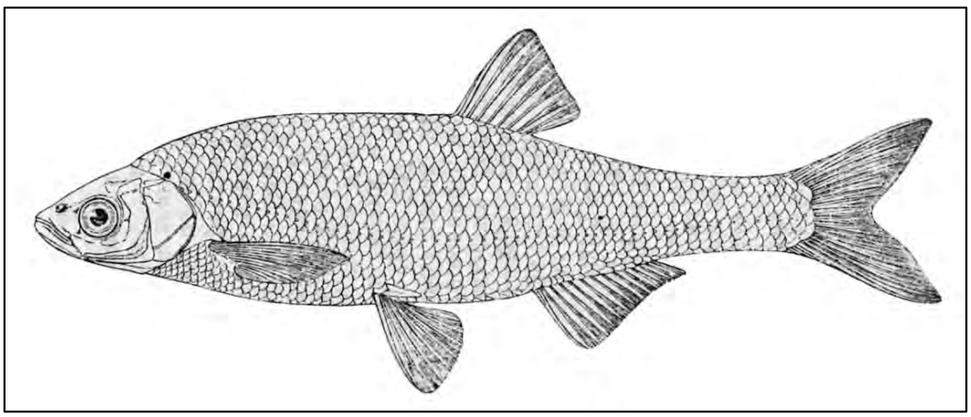
Cyprinus clupeoides Pallas, 1776 from the Caspian Sea, Terek and Kura rivers (also spelled *clupoides* in error) (no types known), possibly *Leuciscus albuloides* Valenciennes, 1844 from "rivières de Perse" (types not given in *Catalog of Fishes*, downloaded 30 May 2018), *Alburnus longissimus* Warpakhovskii, 1892 from the Geoktapinka River, Lenkoran District, Azerbaijan and *Alburnus latissimus* Kamensky, 1901 (no types known) from the mouth of the Kura River, Azerbaijan are synonyms. Since *Alburnus latissimus* occurs with *Alburnus chalcoides* in the Kura River, its status is necessarily equivocal.



Alburnus longissimus, after Abdurakhmanov (1962).



Alburnus longissimus, syntype, BM(NH) 1891.10.7:28.



Alburnus latissimus,
ZISP 14714, Azerbaijan, Kumbashi, Lenkoran District, after Berg (1932b).

Chalcalburnus chalcoides iranicus Svetovidov, 1945 was described as the subspecies of the Iranian shore of the Caspian Sea basin and *Alburnus chalcoides longissimus* Warpakhovskii, 1892 as the subspecies of the Lenkoran in Azerbaijan neighbouring Iran. Coad (1996a) examined the types of *iranicus* and *longissimus* and found them not to be distinguishable. The latter name has priority but both these nominal subspecies, and *latissimus*, are most probably not distinct from the type subspecies. They were founded on small samples from relatively homogenous spawning populations. Variation may be clinal or related to local temperature and other environmental variables. A very large series of specimens would be necessary to define this. The Caspian Sea species may be *Alburnus chalcoides chalcoides* with a distinct subspecies, *Alburnus chalcoides mento* (Heckel, 1836) in the Black Sea basin (now recognised as a distinct species), although up to 13 subspecies were named from Anatolia and the basins of the Black, Caspian and Aral seas.

The type material of *Chalcalburnus chalcoides iranicus* is in the Zoological Institute, St. Petersburg (ZISP 31221, holotype, see below), and three paratypes 142.0-199.9 mm standard length), the type locality being “a small stream near the hospital near Shahi, Talar River basin”

on labels in the Zoological Institute, St. Petersburg and “a small river in the vicinity of town Shakhi (basin of the river Talar, running into the Caspian Sea west of the Gorgan Bay” (Svetovidov, 1945). Shahi or Qa’emshahr is at 36°28'N, 52°53'E. Svetovidov (1945) listed the holotype as a female of total length 263.5 mm and body length 226 mm but the holotype in ZISP is 216.7 mm standard length (Coad, 1996a). The *Catalog of Fishes* (downloaded 30 May 2018) gives further syntypes as ZISP 31222 (6+).

The type material of *Alburnus longissimus* is in the Zoological Institute, St. Petersburg (ZISP 8653, 2 syntypes, 164.8-185.9 mm standard length, from “Fl. Geoktapinka” (Lenkoran). The locality is probably near Prishib at 39°08'N, 48°36'E (Coad, 1996a). ZISP 8654 (6 fish, 121.2-164.4 mm standard length) from the type locality are listed as types in Berg (1911-1914) and the *Catalog of Fishes* (downloaded 30 May 2018) but not in the ZISP catalogue. Also, an *A. longissimus* syntype from St. Petersburg is in the Natural History Museum, London from “R. Geotapinka” (BM(NH) 1891.10.7:28).

Bagherian and Rahmani (2007, 2009) examined two populations, from the Haraz River and the Shirud, morphometrically. The males and the females between the two populations were different, but this was attributed to environmental factors. Truss analysis separated the two populations. Rahmani and Hasanzadeh Kiabi (2007) were able almost to separate the two populations using meristic characters. Rahmani *et al*. (2006) were able to separate populations from the Gazafrud and Haraz rivers using morphometric characters but not meristic ones. Rahmani *et al*. (2009, 2012) used the 18S rRNA and cytochrome *b* genes and found populations from the Gazafrud, Haraz and Shirud rivers were homogenous. Mohaddasi *et al*. (2013) analysed morphometric differentiation in fish from the Babol, Lisa and Shirud rivers and the Anzali region and found samples from the Anzali region were clearly distinct and diverged from the other three populations probably because of difference in habitat conditions. Generally, female samples showed more morphometric differences than male samples did. Mohammadian-kalat *et al*. (2013) suggested this species may be a species complex based on morphology and molecular data. Mouludi-Saleh *et al*. (2020) compared fish from the Chelvand (Astara), Khalesara (Talesh), Siah Darvishan (Anzali Wetland), Sefid and Pol (Gilan), and Tonekabon and Babol (Mazandaran) rivers using meristics and morphometrics and were able to distinguish the populations, with the Chelvand River population in a distinct clade. Abbasi *et al*. (2021) collected fish from the Sefid River (45 autumn and 113 spring samples) and the Siah Darvishan River (22 autumn and 28 spring samples) in the southern Caspian Sea basin and a total of 22 morphometric and eight meristic characters were recorded. The autumn and spring migratory populations had significant differences in seven and two morphometric traits, respectively, but no differences in meristic characters.

A hybrid of *Alburnus chalcoides* and *Vimba vimba persa* (= *V. persa*) was reported from the Sefid River (Petrov, 1926) and a hybrid between *Leuciscus cephalus* (*sic*) and *Alburnus chalcoides* is reported from Turkey (Ünver and Erk’akan, 2005; Ünver *et al*., 2008).

Key characters. This Caspian Sea species is distinguished by having modally 8 branched dorsal fin rays, 54-74 lateral line scales, an abdominal keel partly covered by scales (no more than half naked), and a light brown peritoneum.

Morphology. Body form varies with habitat, fish from the Anzali Lagoon having a larger and more curved body shape, increasing with size, compared to fusiform fish from rivers although the amount of curvature could be independent of the environment (Mohadasi *et al*., 2014). The body is compressed and moderately deep, being deepest between the end of the pectoral fin and the pelvic fin origin. The predorsal profile is straight in front of the dorsal fin,

falling to the head or mostly straight or gently convex. A slight nuchal hump may develop. The caudal peduncle is compressed and shallow. The head tapers to a pointed snout. The eye lies at the beginning of the anterior half of the head and can be quite large. The mouth is oblique and superior or terminal with the lower jaw projecting. It extends back level with the nostril. Lips are thin. The dorsal fin has a straight, slightly rounded or slightly concave margin and its origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the beginning to middle of the anal fin. The caudal fin is moderately to deeply forked with rounded to pointed tips and a larger, more rounded lower lobe. The anal fin margin is rounded at its beginning and slightly emarginate thereafter or mostly straight. The fin does not extend back to the caudal fin base. The pelvic fin is rounded and does not reach back to the anal fin. The pectoral fin is rounded and falls short or extends back to the pelvic fin origin.

Dorsal fin with 2-3, usually 3, unbranched and 7-9, usually 8, branched rays, anal fin with 3 unbranched and 10-21 branched rays (usually 14-15), pectoral fin branched rays 13-16, and pelvic fin branched rays 7-9. Ginzburg (1936) gave counts of 13(7), 14(34), 15(52), and 16(7) for anal fin rays from Iranian material, modally different from my counts below (possibly the last two rays were counted separately but variation between samples is also possible). Lateral line scales 54-74. There is a well-developed pelvic axillary scale. The ventral keel is only naked near the vent (Berg, 1948-1949) and rarely may be scaled along its entire length although Kottelat and Freyhof (2007) have an exposed keel of 8-12 scale lengths, up to 80% of the anus to pelvic fin base distance. Scale shape is a vertical oval. The dorsal and ventral scale margins are parallel or rounded. The anterior margin is wavy or has a pronounced central protuberance with indentations above and below. The posterior scale margin can be rounded and more or less smooth, or rounded and finely crenulate. Crenulation may be related to size or sexual maturity but is not always evident even in spawning males. Circuli are numerous and fine, radii are few and present on the anterior and posterior fields (a few fish had some scales with no anterior radii), and the focus is slightly subcentral anterior. Total gill rakers 18-31 (usually 20-23), serrated medially and elongate, reaching the second or third adjacent raker when appressed. Pharyngeal teeth are 2,5-5,2, more rarely 2,5-5,1, 2,5-5,3, 2,5-5,4 or 3,5-5,3. Teeth are elongate, slender, curved inward, strongly hooked at the tip and strongly serrated with serrations on the anterior margin of the long, narrow and concave grinding surface. The most posterior main row tooth may lie medial to the second tooth. The gas bladder is pointed posteriorly (rounded in *Alburnus hohenackeri* and *A. filippii*). The gut is an elongate s-shape. Total vertebrae number 41-45.

Shabanipour and Haghi (2019) detailed the retinal structure in embryos, larvae and adults. Zakeri Nasab *et al*. (2018, 2018, 2018) described the morphology, histology and histochemistry of the gut and accessory glands in this species. Zakeri Nasab *et al*. (2018) used histology and electron microscopy to describe the ontogenetic development of the digestive system in larvae and juveniles and Zakeri Nasab *et al*. (2020) general morphology, in particular the mouth, useful in the timing of a practical diet for fry.

Meristic values for Iranian specimens are as follows (the types of *C. chalcoides iranicus* are included here):- dorsal fin branched rays 7(3), 8(55) or 9(2); anal fin branched rays 12(1), 13(4), 14(33), 15(19) or 16(3), pectoral fin branched rays 13(4), 14(9), 15(34) or 16(13), pelvic fin branched rays 7(2), 8(57) or 9(1), lateral line scales 54(1), 55(2), 56(2), 57(5), 58(8), 59(5), 60(14), 61(7), 62(5), 63(6), 64(2), 65(1), 66(1) or 67(1), total gill rakers 18(1), 19(5), 20(12), 21(15), 22(14), 23(9), 24(3) or 25(1), pharyngeal teeth 2,5-5,2(30), 2,5-4,2(1), 2,4-5,2(1) or 2,5-5,3(1), and total vertebrae 42(2), 43(9), 44(32) or 45(7). Khataminejad *et al*. (2015) found fish

from the Babol River had 13-19 anal fin branched rays and 60-68 lateral line scales.

Sexual dimorphism. Abdurakhmanov (1962) reported the eye diameter and anal fin base to be larger in males on average for fish from the Kura River basin in Azerbaijan. Iranian males taken in July have small tubercles scattered on top of the head and fine tubercles lining the anterior flank scales. Females are larger than males (Bagherian and Rahmani, 2007).

Colour. The overall colour is metallic silvery and the back is a contrasting olive-green to dark green. The iris is bright silver. There is no dark band along the sides. The dorsal and caudal fins are greyish and the other fins colourless to whitish. The peritoneum is light brown but with numerous melanophores in contrast to the dark peritoneum in some other *Alburnus* species.

Size. Reaches 50.0 cm and 1.5 kg (Machacek (1983-2012), downloaded 27 July 2012). Shemaya on the Kura River of Azerbaijan are larger than those in the south Caspian, up to 36 cm as opposed to 29 cm.

Distribution. Found from central Europe to the basins of the Black, western and southern Caspian and Aral seas. It is recorded from the entire southern coast of the Caspian Sea and its rivers, including the Aras, Astara, Atrak, Babol, Behambar, Chalus, Chamkhaleh, Chapak, Chelond, Chelvand, Chobar, Fereydun Kenar, Gazafrud, Ghasemlou, Gholab Ghir, Golshan, Gorgan, Haraz, Haviq, Kargan, Khalesara, Khazar, Kheyrud, Kia, Lale, Langarud, Larim, Lashtenesha (= Lasht Nesha'), Lavandevil, Lisar, Lomir, Marbureh, Masuleh-Rukhan, Molahadi, Nahang, Nerissi, Nesa, Pir Bazar, Polrud (= Pol-e Rud), Qareh Su, Qezel Owzan, Rasteh, Sardab, Sefid, Shafa, Shah, Shalman, Sheikan, Shirabad, Shirud, Siah, Siah Darvishan, Sorkh, Sowsar, Tajan, Talar, Tonekabon and Valiabad rivers, the Manjil, Nazdik, Saungar, Sefid and Zire dams, the Anzali Talab including the Siahkeshim Protected Region, Anzali Port, Ghazian region at Anzali, Fereydun Kenar International Wetland, Valasht Lake, Gorgan Bay, and the southeast, southwest and south-central Caspian Sea generally (Derzhavin, 1934; Svetovidov, 1945; Kozhin, 1957; Holčík and Oláh, 1992; Shamsi *et al*., 1997; Karimpour, 1998; Abbasi *et al*., 1999, 2007, 2017; Kiabi *et al*., 1999; Abdoli, 2000; Nazari, 2002; Bagherian and Rahmani, 2007, 2009; Rahmani *et al*., 2007, 2009; Banagar *et al*., 2008; Abdoli and Naderi, 2009; Daei *et al*., 2009; Piri *et al*., 2009; Shirvani and Jamili, 2009; Nikoo *et al*., 2010; Patimar *et al*., 2010; Ahmadpour *et al*., 2012; Garedaghi and Mohammadi Hefz Abad, 2012; Khataminejad *et al*., 2013, 2015; Mohadasi *et al*., 2013; Rahbar *et al*., 2013; Abdoli *et al*., 2014; Amouei *et al*., 2014; Mohammadian-Kalat *et al*., 2017; Neurasteh *et al*., 2017; Moshfegh *et al*., 2018; Mouludi-Saleh *et al*., 2020; Shahnazari *et al*., 2020; Aazami and Alavi Yeganeh, 2021; Abbasi *et al*., 2021).

Alburnus chalcoides aralensis Berg, 1926 is reported from the Karakum Canal in Turkmenistan (Shakirova and Sukhanova, 1994; Sal'nikov, 1995) and may eventually be found in the Hari River and Caspian Sea basins of Iran. It is recognised as a synonym of *A. chalcoides* however (*Catalog of Fishes*, downloaded 30 May 2021).

Zoogeography. A widespread species with numerous nominal subspecies which have not all been fully investigated. It presumably originated as part of a Danubian or Sarmatian fauna and the subspecies have become isolated in parts of this former basin.

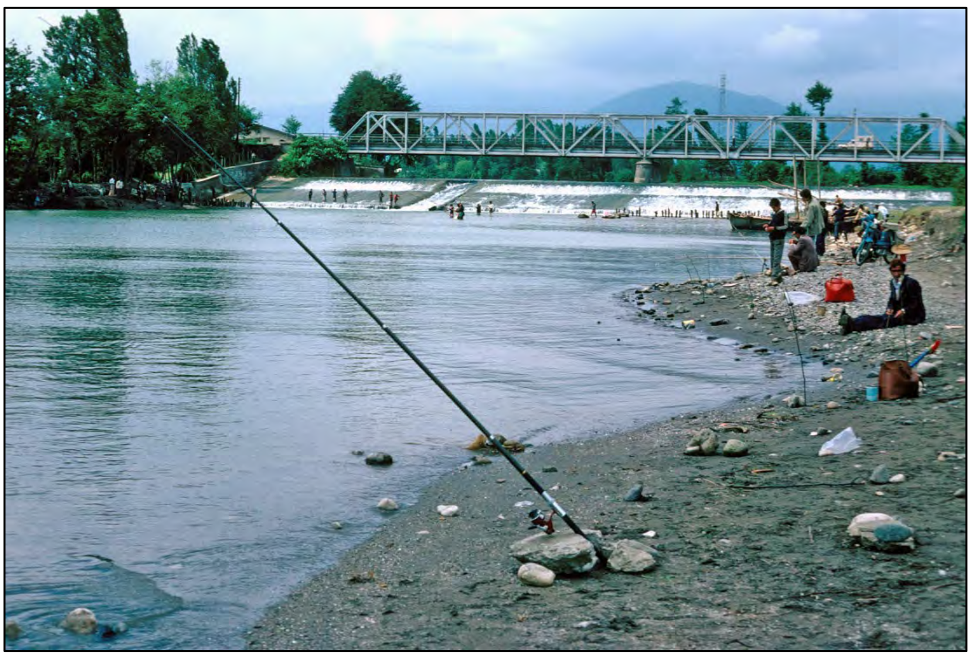
Habitat. This species is found in rivers, streams, dams, lagoons, marshes and brackish environments. Some populations are landlocked while others are semi-anadromous. Knipovich (1921) reported this species from depths of 23.8-25.6 m in the Iranian Caspian Sea. Kottelat and Freyhof (2007) recorded a tolerance of 14‰ salinity generally, and Moshfegh *et al*. (2018) 10.5‰ for the Lale River in Gilan. Riazi (1996) reported that this species is native (resident) to the Siahkeshim Protected Region of the Anzali Talab. It has been caught at 31-32°C in the Sefid River estuary on 9 July 1962 (CMNFI 1970-0565, CMNFI 1980-0908) and at 9°C in the Caspian

Sea near the Lale River.

Young are rheophilous (Abdurakhmanov, 1975). A migration to piedmont and montane zones used to occur before dams and weirs obstructed movements.

Shahlapour *et al*. (2018) found only a low abundance of juveniles of this species in the eastern Caspian Sea, attributed to destruction of riverine habitats and illegal fishing of adults.

Shape differences found by Bagherian and Rahmani (2007) in two Iranian rivers were attributed to the Haraz River having a muddy estuary, a shallow slope to the bottom, high turbidity and low water flow in contrast to the Shirud which was sandy with high water flow and high clarity. The latter population developed a slenderer body due to increased resistance to water flow. Mohadasi *et al*. (2013) also found shape differences between fish from a lagoon (Anzali) and three rivers, the former being larger, more fusiform and slimmer in the caudal peduncle. The fusiform shape was discrete from water flow (slow in the Anzali Lagoon), and was related to larger size when fish attained this shape. One river population (Lisar) had a larger abdominal circumference, smaller size and an upturned mouth, compared to fish from the Babol and Shirud. This was attributed to a poor environment and surface feeding in the former, while the two latter rivers were environmentally similar and less remote. These anadromous fishes have a common origin but habitat features might create selective pressures resulting in morphological divergence.



Habitat of *Alburnus chalcoides* (and *Alburnoides tabarestanensis*, *Alburnus hohenackeri*, *Capoeta razii* and *Vimba persa* among cyprinoids),
CMNFI 1979-0435, Gilan, river west of Ramsar, 4 June 1978, Brian W. Coad.

Age and growth. Life span is 5 years with a theoretical limit of 6.5 years in Azerbaijan (Abdurakhmanov, 1975) and at least 5 years in Iran (Holčík and Oláh, 1992) and Turkey (Tarkan *et al*., 2005). Azari Takami and Rajabi Nezhad (2003) gave 8^+ years for fish from the Sefid River. Sexual maturity was attained at 3 years of age in Azerbaijan and growth was most rapid at an age of 2 years, decreasing thereafter because of high natural mortality (Abdurakhmanov, 1975). The fishes on the spring spawning run in the Anzali Talab were 10.5-29.0 cm standard length, average 14.0 cm, and 2-5 years old with most (63%) fish in age group 3. Males matured

at 2-4 years and females at 3-5 years. Growth was high during the first 3 years of life and then declined (Holčík and Oláh, 1992). Karimpour *et al*. (1993) found the Anzali Talab population to be smaller than the Kura River population but the talab fish showed greater growth after maturation. The spawning migration into the talab began in March and peaked in May and at the beginning of June. Length range was 10.0-24.0 cm, average 16.2 cm, with a mean weight of 64.7 g. Age composition was 2-5 years with three-year-olds comprising 62.5% of the fish. Females formed 57% of the migrating fish. Rahmani (2008) investigated 704 specimens in the Haraz and Shirud rivers and found maximum length and weight in a five-year-old female at 25.1 cm and 96 g, the most abundant age groups were 2^+ and 3^+ years for males and females respectively, males in the Shirud population were heavier and longer on average in younger ages while differences in females were not significant, and females of the Shirud population has isometric growth while Haraz fish had positive allometry. The von Bertalanffy growth parameters were $L_t = 405.9\ (1\text{-}e^{-0.1(t+1.54)})$ for males in Haraz and $L_t = 442.6\ (1\text{-}e^{-0.1(t+1.43)})$ for females in Haraz, and $L_t = 359.5\ (1\text{-}e^{-0.145(t+1.002)})$ for males in Shirud and $L_t = 405.9\ (1\text{-}e^{-0.1(t+1.54)})$ for females in Shirud. Females had a higher L_∞ while K values for males were relatively higher in the two rivers. Rahmani *et al*. (2009) found growth was better in the Shirud compared with other populations because this river had desirable biological parameters for immigration. Patimar *et al*. (2010) compared fish up to 24.3 cm total length from the Siah and Gorgan rivers and found a five-year life cycle, with negative allometric growth for Siah males and positive allometric growth for Siah females and for both sexes in the Gorgan, and sex ratios were unbalanced in favour of females in both rivers. The von Bertalanffy growth parameters were $L_t = 370.08\ (1\text{-}e^{-0.15(t+0.70)})$ for males in Siah and $L_t = 432.52\ (1\text{-}e^{-0.11(t+1.21)})$ for females in Siah, and $L_t = 371.79\ (1\text{-}e^{-0.14(t+0.96)})$ for males in Gorgan and $L_t = 436.10\ (1\text{-}e^{-0.11(t+1.34)})$ for females in Gorgan. Amouei *et al*. (2014) examined fish from the Shirud, Haraz River, Gazafrud and fish markets finding a maximum age of 4^+ years with a maximum total length of 28.3 cm. The length-weight relationship was $W = 0.141TL^{2.199}$ indicating negative allometric growth. The male:female sex ratio was 1:2.12 but this was based on 53 fish grouped from various localities.

Mazandaran, Haraz River at Vana Bridge
(Haraz river and Vana bridge, CC BY 3.0, Alireza Javaheri).

Poorpoode and Rahmani (2013) found a length-weight relationship of $W = 0.000002TL^{3.295}$ for males (positively allometric) and $W = 0.000009TL^{2.972}$ for females (isometric) for fish from the Shirud. The average length and weight of females was higher than males. von Bertalanffy growth equations were $L_t = 245.2(1\text{-}e^{-0.32(t-0.017)})$ for males and $L_t = 238.6(1\text{-}e^{-0.25(t+1.45)})$ for females. In both sexes the highest instantaneous growth rate was at the age of 1 year, significantly decreasing with age. Mousavi-Sabet *et al*. (2014) gave a *b* value of 2.672 for 30 fish, 12.46-18.47 cm total length, from the Babol River. Sorosh Hadad *et al*. (2018) examined 77 fish caught in beach seines from Astara, Anzali and Kiashahr and found a mean length of 19.25 cm, a mean weight of 76.78 g, an age range of 0-4 years with age class 0-1 accounting for 81.8% of the catch, heterogeneous or allometric growth, condition factors of 0.83 and 0.82 in males and females, mean gonadosomatic indices of 8.04 and 3.05 in females and males, and mean hepatosomatic indices of 0.79 and 0.75 in males and females. Abbasi *et al*. (2021) found length-weight relationship parameters revealed that Sefid River populations have an isometric growth pattern and the autumn and spring populations of the Siah Darvishan River showed positive allometric and isometric growth patterns, respectively.

Food. Holčík and Oláh (1992) reported a feeding migration in July to September in the western basin of the Anzali Talab. Gut contents included diatoms and algae, dragonfly larvae, and copepods in Azerbaijan (Abdurakhmanov, 1962). Rajabi Nezhad and Azari Takami (2009) found fish caught from the estuary to Kisom on the Sefid River fed on Chrysophyta, Chlorophyta, Cyanophyta, Copepoda and Cladocera, along with some chironomid larvae and the diatom *Gomphonema*. The main food was zooplankton. Iranian fish examined by me had plant fragments, sand grains, crustaceans, insect remains and chironomid larvae in gut contents.

Reproduction. Svetovidov (1945) considered that Iranian populations (his *iranicus*

subspecies) spawned nearly throughout the year since fish having ripe sex products were caught in both July and February and young were found along the Iranian coast throughout the year. Spawning took place in the sea, in areas such as Gorgan Bay, and in the lower reaches of rivers. Nikoo *et al*. (2010) measured serum sex steroids during spawning in the Valiabad River and concluded that this fish may be a multiple spawner. Khaval (1998) reported a spawning migration into the Sefid River despite construction, sand removal and pollution. Holčík and Oláh (1992) reported a migration into the Anzali Talab for spawning in late February to early April (but see above; possibly a confusion between the migration at an earlier date than the spawning act).

Karimpour *et al*. (1993) gave an absolute fecundity of 6,630 eggs in the Anzali Talab population while mean relative fecundity was 140 eggs/g of body weight. Iranian fish had 1.5 mm eggs as early as 13 March (fish standard length 213.2 mm) and 1.7 mm eggs on 4 June (fish length 154.6 mm) while eggs are only 1.3 mm on 15 July (fish length 142.8 mm). Larger fish may mature and spawn earlier than younger fish. Rahbar *et al*. (2008) found Anzali Wetland or Talab spawning migrants had a highest absolute fecundity of 8,301.21 eggs and average number of ovules per gramme body weight was 821.79 for three-year-olds (minimum for two-year-olds). Maximum average relative fecundity (109.89) and gonadosomatic index (14.49%) were found in in two-year-olds (minimum in three-year-olds). Rahbar *et al*. (2013) found Anzali Wetland fish age 2 years had an absolute fecundity of 4,447.84 eggs, a relative fecundity of 86-177 (mean 109.89), and an egg diameter of 1.13-1.26 (mean 1.17 mm) while in three-year-old fish it was 8,301.21 eggs, 75-133 (mean 99.21).and 1.13-1.27 (mean 1.18). Pouresmaeilian *et al*. (2015) examined male migrants to the Anzali Wetland describing the histology of the gonads and the rate of sex steroid production, finding that the physiological role of testosterone is more in spermiation than spermatozoa. Pouresmaeilian *et al*. (2016, 2017) described sex steroid levels, reproductive indices and the histology of gonads in males and females from the Anzali Wetland. Absolute fecundity was 7,467.23 eggs in 2^+ matured fish and 568.01 eggs in 3^+ fish. Oocyte diameter was 774.21 and 806.6 μm respectively and in ripe fish averaged 792.4 μm. This species is probably a multiple spawner with a protracted spawning period and showed higher levels of sex steroids in matured fish, compared to maturing fish, probably as a consequence.

Azari Takami and Rajabi Nezhad (2003) collected 539 specimens of this species from the sea shore to Kisum (= Kisom) on the Sefid River, finding Astaneh and Kisom were favourable sites for spawning. The maximum fecundity was 18,860 eggs for eight-year-old fish and the minimum was 2,929 eggs for three-year-old fish. Relative fecundity was 132 and there were 72 eggs/g (*sic*). Rahmani *et al*. (2009) found a peak gonadosomatic index for males in May and for females in early June in the Shirud. Average fecundity was about 3,900 eggs with diameter reaching 1.17 mm. Patimar *et al*. (2010), in their study of Siah and Gorgan River fish, found spawning between April and July in the Siah and March and June in the Gorgan, peaking in May in both rivers. Absolute fecundity was up to 38,340, mean 8,426 eggs, in the Siah and up to 17,263, mean 4,215 eggs, in the Gorgan. Relative fecundity was up to 599, mean 212 eggs/g, of body weight in the Siah and up to 696, mean 112 eggs/g, in the Gorgan. Mean egg diameters were 1.4 mm in the Siah and 1.27 mm in the Gorgan. These differences in life history (see also **Age and growth** above) were attributed to differing habitat characteristics.

Rahbar *et al*. (2013) found fish from the Sefid, Chamkhaleh and Shirud rivers had egg diameters 1.07-1.25 (mean 1.18), 0.64-1.24 (1.11) and 1.03-1.23 (1.12) mm, absolute fecundity 1,665-3,642 (mean 2,613.97), 1,971-5,550 (3,659.0) and 1,829-8,206 (3,728.7) eggs, and relative fecundity 67-165 (mean 108.7), 69-158 (101.06) and 81-149 (113.15) eggs/g, all respectively.

Fish from the Sefid had the maximum gonadosomatic index and those from the Chamkhaleh the lowest. Values varied between the three localities in reproductive characters.

This species is an intermittent spawner with three batches of eggs, only two of which are laid at an interval of 18-19 days in Azerbaijan. Fecundity reached 54,700 eggs there but this was less than that of diadromous populations. Egg diameter was up to 1.9 mm. Spawning took place in the second half of July to the end of August at water temperatures of 18-25°C in the Mingechaur Dam in Azerbaijan. Sticky eggs were laid on rocky bottoms in 15-20 cm of water after a migration into streams or on rocky grounds of reservoirs (Abdurakhmanov, 1962, 1975; Elanidze, 1983). There is a spawning migration into the Kura River from October to April, peaking in December-January, with spawning taking place in spring in the upper reaches (Berg, 1959). In Lake Tuş, Turkey spawning occurred in May-June, egg numbers reached 20,971 and average egg diameter 1.05 mm (Balık *et al*., 1996).

Parasites and predators. Molnár and Jalali (1992) reported the monogeneans *Dactylogyrus minor*, *D. alatus* and *D. vistulae* from this species in the Ghasemlu River, an inland watershed, with the latter species also in the Sefid River. They also described a new species of monogenean, *Dactylogyrus holciki*, from this species in the Beshar River of the Persian Gulf drainage, possibly confusing this Caspian Sea basin cyprinid with *A. sellal*. Molnár and Jalali (1992) also recorded the monogenean *Dactylogyrus chalcalburni* from the Sefid and Zayandeh rivers, although this Caspian Sea basin species does not occur in the latter locality, possibly being *A. doriae*. Shamsi *et al*. (1997) reported *Clinostomum complanatum*, a parasite causing laryngo-pharyngitis in humans, from this species in the Shirud. Masoumian and Pazooki (1998) surveyed myxosporeans in this species in Gilan and Mazandaran provinces, finding *Myxobolus pseudodispar*. The helminths *Pentagramma symmetrica* and *Mazocea alaosa* were recorded from the guts of *Chalcalburnus tarichi* (*sic*, presumably *A. chalcoides*) from the Anzali Wetland (Ataee and Eslami, 1999; www.mondialvet99.com, downloaded 31 May 2000). Naem *et al*. (2002) found the monogenean trematodes *Dactylogyrus chalcalburni* and *Gyrodactylus* sp. on the gills of this species from the western branch of the Sefid River. Sattari *et al*. (2004, 2005) surveyed this species in the Anzali Wetland, recording *Anisakis* sp. Maleki and Malek (2007) examined fish from the Shirud and recorded the digeneans *Posthodiplostomum cuticola*, *Diplostomum spathaceum*, *Clinostomum complanatum* and *Allocreadium* sp. Sattari *et al*. (2007) found the nematode *Anisakis* sp., the digenean *Diplostomum spathaceum* and the monogenean *Dactylogyrus extensus* in this species in the Anzali Wetland. Miar *et al*. (2008) examined fish in Valasht Lake and the Chalus River, Mazandaran and found the metazoan *Argulus foliaceus*. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Argulus foliaceus* on this species. Garedaghi and Mohammadi Hefz Abad (2012) found plerocercoid larvae of *Ligula intestinalis* in the abdomen of fish from the Saungar Dam in Gilan. Mirhashemi Nasab *et al*. (2017) found *Diplostomum spathaceum* in fish from the Anzali Wetland with prevalence (25.0%) and range (1-6 worms in a fish). Barzegar *et al*. (2018) reported the monogenean *Gyrodactylus prostae* from the Tajan and Talar rivers in Mazandaran. Moumeni *et al*. (2020) recorded the zoonotic *Clinostomum complanatum* from this species in Iran.

Ashoori *et al*. (2017a) recorded this species as an occasional item in the diet of young black-crowned night herons (*Nycticorax nycticorax*)) in the Anzali Wetland.

Economic importance. The shemaya was a valuable edible fish on the Kura River of Azerbaijan with catches as high as 500 centners (1 centner = 100 kg) prior to construction of the Kura dam. The catch for Azerbaijan in 1933 was 1,950 centners or 2,029,000 fish. Catches in the Mingechaur Dam were 133 centners in 1972 (Abdurakhmanov, 1975). Reputedly delicious

eating (Lönnberg, 1900b). They are fished for on the spawning run when fatty. In Iran, they are caught by cast nets in the inlets and outlets of the Anzali Talab in spring on the spawning run and by gill nets in the western basin on the feeding migration. Holčík and Oláh (1992) reported a catch of 956 kg in the Anzali Talab in 1990 but catches in recent years may have been confused with the exotic *Hemiculter leucisculus* (Holčík and Olah, 1990). It has been termed a commercial or semi-commercial species by Falahatkar *et al*. (2015). Moradinasab *et al*. (2015) noted its presence in the kilka by-catch (*Clupeonella* spp., Clupeidae) on the Bandar-e Anzali fishing grounds although it, along with five other species, only comprised 0.2% of the kilka catch.

Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use in aquaculture and as food.

Experimental studies. Zolfaghari *et al*. (2007) found mercury levels in muscle of fish (identified as *Chalcalburnus chalcalburnus*, presumably the present species) from the Anzali Wetland were below dangerous levels. Shirvani and Jamili (2009) found excessive levels of cadmium and lead in this fish from regions of Anzali where oil ship traffic was highest. Daei *et al*. (2009) reported on the effects of cadmium and lead on the iron solute in blood. Panahandae *et al*. (2013) examined levels of cadmium, chromium and lead in fish from the Anzali Talab and found no levels exceeded international standards. Sadeghi *et al*. (2018) found average accumulation of chromium and cobalt in fish from the Anzali Lagoon and Shirud was not significantly different, chromium in skin and gill tissues (but not muscle) at both stations was higher than standard levels, and cobalt was higher than standard levels in the Anzali Lagoon.

This species has been artificially bred without hormones on the Shirud with a fertilisation rate of 90-98%. Hatching took six days and the hatching rate was 57% (*Iranian Fisheries Research Organization Newsletter*, 36:4, 2003). On the Tajan River, induction of ovulation has been carried out using LRH-Aa with metoclopramide and carp pituitary extract (Yousefian *et al*., 2008). Fertilisation rate was 83%, hatching rate 90% and survival of larvae 81%. Nosrati *et al*. (2017) studied the effects of injection of pituitary extract, ovaprim (a commercial spawning inducing agent) and HCG hormones in combination with metoclopramide for inducement of maturation and artificial reproduction performance in fish from the Sefid River. A wide variation in reproductive parameters was found and the best dose for germinal replenishment was 20 μg/kg ovaprim. Nosrati *et al*. (2017) injected various pituitary doses at different temperatures for artificial reproduction. The most suitable dose was 1-3 mg/kg at a temperature of 17-20ºC. Sufficient duration of egg washing with ordinary water was 30 minutes. The rate of fertilisation was between 85-98%, incubation dry egg diameter was 1.5 mm and swollen ones 1.8 mm, absolute fecundity varied between 3,227-14,654 eggs, during 3 months of culture the fry had an average weight of 2.8 g, and survival rate of the larvae was 65-80%.

Neurasteh *et al*. (2017) found that fish consumed a high level of energy just after breeding and while returning to the Caspian Sea based on gill chloride cell numbers (highest in the sea, lowest in the river) and plasma prolactin levels (the reverse). Bahrpeyma *et al*. (2017) examined haematological parameters and found red blood cell count, haemoglobin and haematocrit values were significantly higher in males than in females, these parameters were significantly higher in the river than in the sea and estuary, and in the summer than other seasons. Blood factors had significant negative correlations with water salinity and total length as well as weight of fish, and a significant positive correlation with water temperature. Bahrpeyma *et al*. (2018) studied the distribution of lymphoid cells in the kidney of fish from Gilan and found a significant negative correlation with salinity so that their distribution in the sea was significantly less than that in the river and estuary. Distribution of lymphoid cells was not

statistically significant based on fish gender but had a reverse correlation with age, total length and weight. Moshfegh *et al*. (2018) demonstrated differences in sex, habitat and seasonal variation caused variation in haematology and plasma chemistry intervals for migrating fish. Zakeri Nasab *et al*. (2020) studied the ontogeny of alterations in digestive enzymes, important in culturing the species.

Conservation. Holčík and Oláh (1992) reported a decline in the numbers of this species owing to damming of rivers where it used to spawn. Kiabi *et al*. (1999) considered this species to be near threatened in the south Caspian Sea basin according to IUCN criteria. Criteria included commercial fishing, sport fishing, abundant in numbers, habitat destruction, widespread range (75% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. Mostafavi (2007) listed it as near threatened in the Talar River, Mazandaran. Pouresmaeilian *et al*. (2017) and Moshfegh *et al*. (2018) considered this species to be vulnerable to endangered in the south Caspian Sea basin because of damming of rivers, overfishing during the spawning season and deterioration of spawning grounds. Endangered in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Lelek (1987) classified this species as vulnerable to endangered in Europe.

Sources. A review of this species was given by Falahatkar *et al*. (2015).

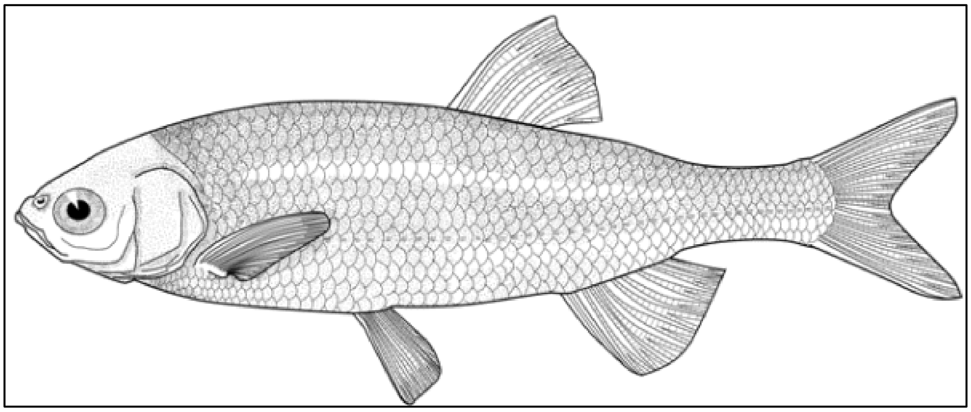
Type material:- *Chalcalburnus chalcoides iranicus* (ZISP 31221) and *Alburnus longissimus* (ZISP 8653, possibly ZISP 8645 and BM(NH) 1891.10.7:28).

Iranian material:- CMNFI 1970-0507, 16, not kept, Gilan, Caspian Sea at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0509, 40, 34.4-61.2 mm standard length, Gilan, Sefid River at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0510, 10, 31.8-42.8 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0512, 1, not kept, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0513, 4, 29.4-34.3 mm standard length, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0516, 12, 16.8-35.2 mm standard length, Gilan, Lomir River (38º14'N, 48º52'30"); CMNFI 1970-0518, 26, 20.5-38.6 mm standard length, Gilan, Haviq River estuary (38º10'N, 48º54'E); CMNFI 1970-0519, 55, 16.5-41.8 mm standard length, Gilan, Chelvand River (ca. 38º18'N, ca. 48º52'E); CMNFI 1970-0520, 8, 33.3-47.4 mm standard length, Gilan, Astara River (ca. 38º25'N, ca. 48º52'E); CMNFI 1970-0522, 75, 22.1-71.2 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0525, 9, 36.1-52.9 mm standard length, Gilan, Sefid River near Mohsenabad (ca. 37º22'N, ca. 49º57'E); CMNFI 1970-0526, 7, 45.6-64.5 mm standard length, Gilan, Sefid River below Astaneh Bridge (37º19'N, 49º57'30"E); CMNFI 1970-0527, 36, 16.9-27.2 mm standard length, Gilan, Sefid River near Kisom (37º12'N, 49º54'E); CMNFI 1970-0528, 3, not kept, Mazandaran, Tajan River estuary (36º49'N, 53º06'30"E); CMNFI 1970-0531, 4, 64.5-74.9 mm standard length, Mazandaran, Larim River talab (36º46'N, 52º58'E); CMNFI 1970-0537, 1, not kept, Gilan, Shah River above Manjil Dam (36º44'N, 49º24'E); CMNFI 1970-0542, 4, not kept, Gilan, Old Sefid River estuary (37°23'N, 50°11'E); CMNFI 1970-0543, 26, 34.5-50.1 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0548, 3, not kept, Mazandaran, Qareh Su (no other locality data); CMNFI 1970-0549, 2, 39.0-41.2 mm standard length, Mazandaran, Qareh Su near Alm Emamzadeh (no other locality data); CMNFI 1970-0553, 2, 101.9-163.1 mm standard length, Gilan, Sowsar Roga River (37º27'N, 49º30'E); CMNFI 1970-0563, 74, not kept, Gilan, Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0565, 1, 50.3 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1970-0570, 19, not kept, Gilan, Caspian Sea at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0578, 8, 29.7-46.4 mm standard length, Gilan, Sefid River below Astaneh Bridge

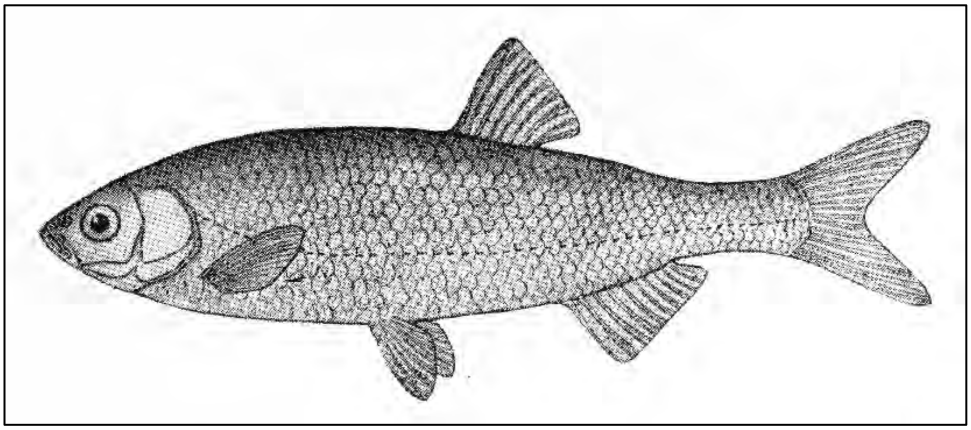
(37º19'N, 49º57'30"E); CMNFI 1970-0581, 18, 24.8-56.5 mm standard length, Gilan, Caspian Sea near Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0583, 3, 38.0-47.2 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0587, 8, not kept, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0589, 3, 26.4-53.6 mm standard length, Gilan, Sefid River opposite Kisom (37º12'N, 49º54'E); CMNFI 1971-0327A, 2, 54.5-116.9 mm standard length, Gilan, Shafa River (37º35'N, 49º09'E); CMNFI 1971-0343, 1, 45.3 mm standard length, Gilan, Langarud at Chamkhaleh (37°13'N, 50°16'E); CMNFI 1979-0081, 7, 77.8-106.5 mm standard length, Mazandaran, Caspian Sea 3 km west of Chalus (36º41'N, 51º24'E); CMNFI 1979-0430, 6, 39.4-39.8 mm standard length, Mazandaran, river 1 km east of Now Shahr (36º39'N, 51º31'E); CMNFI 1979-0434, 4, 47.3-154.6 mm standard length, Mazandaran, Shirud River (36º51'N, 50º49'E); CMNFI 1979-0435, 1, 170.5 mm standard length, Gilan, river west of Ramsar (36º57'N, 50º37'E); CMNFI 1979-0437, 2, 164.5-175.6 mm standard length, Gilan, Sefid River 2 km west of Astaneh (37º16'30"N, 49º56'E); CMNFI 1979-0438, 12, 114.9-158.9 mm standard length, Gilan, Gholab Ghir River (37º27'N, 49º37'E); CMNFI 1979-0439, 2, 156.6-173.2 mm standard length, Gilan, Anzali Talab (ca. 37º27'N, ca. 49º25'E); CMNFI 1979-0441, 1, 109.8 mm standard length, Gilan, river 14 km south of Hashtpar (37º42'N, 48º58'E); CMNFI 1979-0443, 1, 159.6 mm standard length, Gilan, river 34 km north of Hashtpar (38º06'N, 48º53'E); CMNFI 1979-0445, 1, 114.9 mm standard length, Gilan, stream 10 km south of Astara (38º21'N, 48º51'E); CMNFI 1979-0455, 1, 88.5 mm standard length, Qazvin, Manjil Dam (36º45'N, 49º17'E); CMNFI 1979-0473, 2, 24.1-24.2 mm standard length, Mazandaran, Babol River (36º38'N, 52º38'E); CMNFI 1979-0474, 1, 141.0 mm standard length, Mazandaran, Tajan River (36º34'N, 53º05'E); CMNFI 1979-0626, 3, 33.7-46.5 mm standard length, Gilan, Sefid River (no other locality data); CMNFI 1979-0685, 10, 42.1-54.8 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0686, 23, 25.5-111.0 mm standard length, Gilan, Sefid River above ferry (37º24'N, 49º598'E); CMNFI 1979-0696, 17, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1979-0788, 48, 35.2-74.7 mm standard length, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0116, 49, 28.3-70.1 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0117, 2, 45.0-45.4 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0120, 17, 55.3-71.6 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1980-0122, 19, 26.0-50.4 mm standard length, Mazandaran, Nerissi River (36º38'N, 52º16'E); CMNFI 1980-0123, 2, 97.0-106.4 mm standard length, Gilan, Sefid River around Dakha (ca. 37º22'N, ca. 49º57'E); CMNFI 1980-0126, 3, 182.1-213.2 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1980-0129, 1, 35.2 mm standard length, Mazandaran, Tajan River (36º49'N, 53º06'30"E); CMNFI 1980-0131, 2, 34.7-58.9, Iran Caspian Sea basin (no other locality data); CMNFI 1980-0132, 7, 18.7-142.8 mm standard length, Gilan, Sefid River at Kisom (37º12'N, 49º54'E); CMNFI 1980-0135, 5, 27.7-48.7 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 1980-0136, 9, 27.6-45.1 mm standard length, Mazandaran, Fereydun Kenar River estuary (36º41'N, 52º29'E); CMNFI 1980-0138, 14, 24.6-55.7 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1980-0142, 2, 135.0-187.2 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1980-0144, 29, not kept, Mazandaran, Sorkh River (36º40'N, 52º25'E); CMNFI 1980-0147, 1, 39.3 mm standard length, Gilan, Lashtenesha (= Lasht Nesha') River (37º21'N, 49º52'E); CMNFI 1980-0149, 1, not kept, Gilan, Chapak River (37º21'N, 49º50'E); CMNFI 1980-0157, 27, 36.2-77.2 mm standard length, Golestan, Gorgan River estuary (36º59'N, 53º59'30"E); CMNFI 1980-

0905, 3, not kept, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0908, 3, 45.4-155.2 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 2008-0221, 1, 60.3 mm standard length, Gilan, Sefid River (no other locality data).

Alburnus doriae
De Filippi, 1865



Alburnus doriae
Susan Laurie-Bourque @ Canadian Museum of Nature.



Alburnus doriae, after Tortonese (1934).

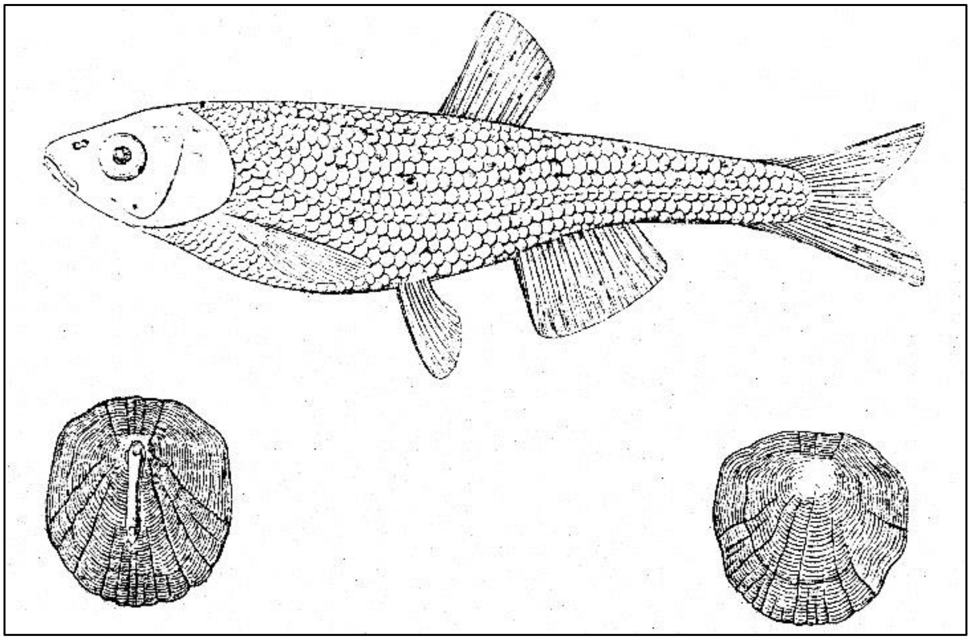
Alburnus doriae, Chahar Mahall and Bakhtiari, Beheshtabad River,
after Jouladeh-Roudbar *et al*. (2020).

Alburnus doriae, Esfahan, Zayandeh River, January 2007, Keyvan Abbasi.

Common names. Aroos or arus mahi (= bride fish), arus mahi-ye Zayandehrud (= bride Zayandeh River fish, Y. Keivany, pers. comm., 25 September 2018).

[Doria bleak; Zayandeh Rud chub (Shojaee *et al*., 2014)].

Systematics. *Alburnus maculatus* Keyserling, 1861 described from "Wasserleitung bei Gaes einige Meilen von Isphahan" (a canal near Gaz a few miles from Esfahan - Wasserleitung may also be translated as water conduit and aqueduct and may have been referring to a qanat stream as canals in the European sense were not present in Iran) (no types kept) is objectively invalid, preoccupied by *Alburnus maculatus* Kessler, 1859 (= *Alburnoides maculatus*) of eastern Europe, the Crimea Peninsula and the Black Sea basin of Ukraine and Russia (*Catalog of Fishes*, downloaded 13 March 2021). *Petroleuciscus esfahani* Coad and Bogutskaya, 2010 described from a stream at Dizaj in the southern Zayandeh River basin, and *Alburnus amirkabiri* Mousavi-Sabet, Vatandoust, Khataminejad, Eagderi, Abbasi, Nasri, Jouladeh and Vasil'eva, 2015 described from the Ghareh Chay River, Namak Lake basin are synonyms (Mohammadian-Kalat *et al*., 2017; Jouladeh-Roudbar *et al*., 2020). However, H. Mousavi-Sabet (*in litt*., 19 January 2021) noted both of the latter are distinct taxa from *A. doriae*, but differences between *A. esfahani* and *A. amirkabiri* need more study. I have retained the synonymies above until further work confirms or rejects them, bearing in mind reservations about DNA evidence expressed elsewhere (see under the description of the genus *Garra* for example). Either or both of these putative synonyms may be distinct but further work is required and the exact type locality of *A. doriae* being unknown (Namak Lake, Esfahan or Tigris River basin) renders untangling synonymies nugatory.



Alburnus maculatus, with lateral line and flank scales, after Keyserling (1861).

Alburnus doriae De Filippi, 1865 has a type locality of “dintorni di Schiraz” (surroundings of Shiraz in Fars) but fish resembling this species have not been caught there in late twentieth and early twenty-first century collections. It seems probable that the fish were collected north of Shiraz, once presumed to be in a Tigris River basin stream based on the other species included in the jar. These materials may, however, have been mixed and the type locality of this species is obscure.

Krupp (1985c) referred five specimens from the type series of *Alburnus doriae* to his *Alburnus sellal* and two specimens to *Squalius lepidus*. The lectotype (MZUT N.720 or MZUT P1110) of *Alburnus doriae* is stored in the Istituto e Museo di Zoologia della R. Università di Torino (122.0 mm standard length as measured by me) and five paralectotypes (MSNG C.E. 9102) of this species are in the Museo Civico di Storia Naturale di Genova (Tortonese, 1934, 1940, 1961), only one of which is *A. doriae* (109.1 mm standard length as measured by me, 122 mm standard length as measured by Mohammadian-Kalat *et al*. (2017)).

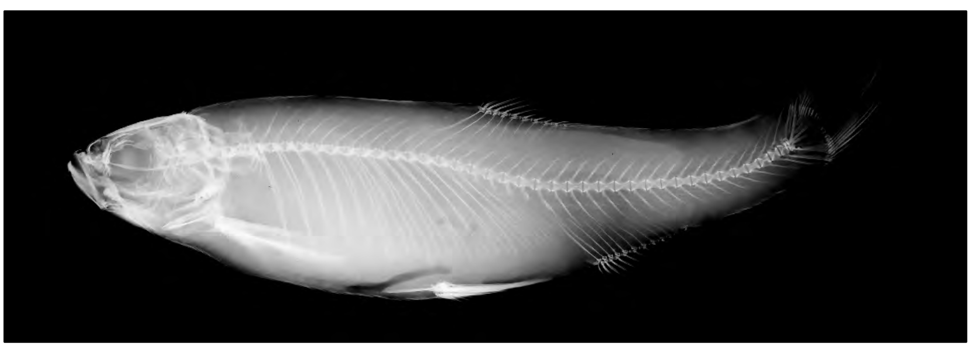
Alburnus doriae, lectotype, MZUT N.720, Franco Andreone.

Alburnus doriae, lectotype, MZUT N.720, Brian W. Coad.

The type locality of *Petroleuciscus esfahani* is Esfahan, stream at Dizaj in the southern Zayandeh River basin, 31°55'N, 51°30'E (holotype, CMNFI 1979-0249, female, 106.7 mm standard length). Paratypes are from Esfahan, stream 1 km east of Daran, Pelasegan River tributary in the northern Zayandeh River basin, 32°59'N, 50°26'E (CMNFI 1979-0251, 134, 22.1-83.7 mm standard length). The species was named after the central Iranian drainage basin in which it was found, itself named for the principal city of Esfahan, then the third largest city in Iran.

Petroleuciscus esfahani, holotype, CMNFI 1979-0249,
James Maclaine @ Canadian Museum of Nature.

Petroleuciscus esfahani, paratype, CMNFI 1979-0251,
Bronwyn Jackson @ Canadian Museum of Nature.



Petroleuciscus esfahani, holotype, CMNFI 1979-0249, Brian W. Coad.

The type locality of *Alburnus amirkabiri* is Markazi Province, Ghareh-Chay (= Qareh Chay) River, in the Namak Lake basin, 34°53′N, 050°02′E. The holotype is under VMFC ALB201H H (VMFC = Vatandoust and Mousavi-Sabet Fish Collection, Tehran), male, 113.2 mm standard length. Paratypes are VMFC AL2010P, male, 101.2 mm standard length and 8 females, 104.0-117.2 mm standard length, same locality as holotype, VMFC AL2040P, 8 males, 73.5-95.6 mm standard length and 22 females 58.2-86.1 mm standard length, same locality as the holotype, and ZMMU P-23620 (Zoological Museum of Moscow State University), 3 males, 101.4-107.5 mm standard length and 7 females 67.5-80.7 mm standard length, same locality as the holotype.

Alburnus amirkabiri, holotype, VMFC ALB201H H, Hamed Mousavi-Sabet.

Shojaee *et al*. (2014) sampled fish identified as *Petroleuciscus esfahani* from Chamgordan (= Cham-e Gordan), Cheshmeh Dineh, Khersoonak and Safaeye Bridge on the Zayandeh River and using microsatellite data found the four populations to be highly diverse, probably because of river landscape fragmentation. Pishkahpour *et al*. (2019a) also found morphometric differences between six populations from Beheshtabad and Junaqan rivers (Karun River basin), at Morshid and Roodbar (Esfahan basin) and the Karaj River and Qareh Chay (Namak Lake basin).

Key characters. This species is distinguished from other *Alburnus* species in Iran by having modally 8 dorsal fin branched rays, 9-12 anal fin branched rays, 44-59 lateral line scales, 12-18 total gill rakers, and a distribution in the Esfahan, Namak Lake and upper Tigris River basins.

Morphology. The body is moderately slender and markedly compressed laterally. It is deepest at the level of the rear of the pectoral fin. The back is slightly convex or almost straight. The caudal peduncle is compressed and moderately deep. The interorbital region is concave. The snout is short and pointed, its length equal to or slightly smaller than the orbit width. The tip of the mouth cleft is on a level with the upper margin of the pupil in large-sized individuals such that the mouth is slightly superior or somewhat below, and at about the level of the middle of the eye in small-sized ones. The lower jaw projects slightly compared to the upper jaw, often forming a distinct chin especially visible in larger specimens. Rarely, the upper and lower lips are at the same level. Lips are moderate in size. The eye is at the beginning of the front half of the head. The dorsal fin margin is straight to slightly convex or slightly emarginate and its origin lies over the level of the last pelvic fin ray or slightly behind, well posterior of the pelvic fin origin level. The depressed dorsal fin extends back level with middle of the anal fin. The anal fin margin is rounded and the fin does not extend back to the caudal fin base. The caudal fin is deeply to moderately or even shallowly forked with the lobes slightly pointed to rounded. The rounded pectoral fin does not reach back to the pelvic fin and the rounded pelvic fin does not reach the anus but may reach the anterior anal papilla.

Dorsal fin with 3 unbranched and 7-9 branched rays, modally 8, anal fin with 3 unbranched and 9-12 branched rays, pectoral fin branched rays 13-17, and pelvic fin branched rays 7-9. Lateral line with 44-59 scales, predorsal scales 23-27, scale rows between lateral line and dorsal fin origin 8-12, scales between lateral line and anal fin origin 4-6, scales between lateral line and pelvic fin origin 2-5, and scales around the caudal peduncle 14-26. A pelvic axillary lobe is present and is elongate. A shallow ventral keel extends between the pelvic and anal fins almost completely covered by scales, being exposed for 2-4 (usually 2) transverse scales rows in front of the anus only. The keel is almost absent in some fish. Scales are oval in

shape with all margins rounded, although the anterior margin may be somewhat wavy. The focus is subcentral anterior, circuli are fine, and radii are few anteriorly and more numerous posteriorly. Total gill rakers 12-18, long reaching the second or third adjacent raker when depressed. Pharyngeal teeth usually 2,5-4,2, hooked at the tip and strongly to weakly serrated below it. The gut is an elongate s-shape. Total vertebrae number 39-45, the abdominal + caudal vertebral formulae being usually 22+19, 22+20 and 21+20. The lectotype has 41 total vertebrae and the holotype of *Petroleuciscus esfahani* has 41 total vertebrae.

Meristic values are:- dorsal fin branched rays 7(36), 8(233) or 9(7), anal fin branched rays 9(16), 10(124), 11(118) or 12(18), pectoral fin branched rays 13(11), 14(55), 15(70), 16(33) or 17(3), pelvic fin branched rays 7(10), 8(140) or 9(22), lateral line scales 44(1), 45(4), 46(5), 47(16), 48(25), 49(16), 50(15), 51(25), 52(10), 53(24), 54(10), 55(7), 56(5), 57(6), 58(1) or 59(2), eight specimens of *P. esfahani* with the lateral line widely interrupted (28-40 pored lateral-line scales from 50-53 scales in lateral series), scales above lateral line 8(1), 9(51), 10(106), 11(13) or 12(1), scales below lateral line 2(2), 3(41), 4(111) or 5(18), scales around caudal peduncle 14(3), 15(12), 16(15), 17(2), 18(37), 19(-), 20(33), 21(1), 22(21), 23(10), 24(12), 25(24) or 26(2), total gill rakers 12(5), 13(16), 14(37), 15(51), 16(35), 17(14) or 18(2), and pharyngeal teeth 2,5-4,2(8), 2,5-5,2(2) or 2,4-4,2(2) (last variant after S. Dorafshan, 24 November 2014). Total number of vertebrae 39(2), 40(22), 41(71), 42(35) or 43(5), abdominal (precaudal) vertebrae including the Weberian and intermediate vertebrae (those vertebrae that lost articulation with ribs and differ in the degree of transformation of the parapophyses into the haemal arch with the haemal spine) 21(39), 22(87) or 23(9), caudal vertebrae 18(12), 19(66), 20(53) or 21(4), and the vertebral formula is 22+19(47), 22+20(28), 21+20(23), 21+19(13), 22+18(9), 23+19(6), 22+21(3), 23+20(2), 21+18(2), 23+18(1) or 21+21(1). The number of predorsal vertebrae (in front of the first dorsal pterygiophore) is 14(52), 15(76) or 16(7) and the number of intermediate vertebrae is 3(17), 4(69), 5(46) or 6(2).

The meristic values above were combined after Coad (1985), Coad and Bogutskaya (2010), Mousavi-Sabet *et al*. (2015) and Mohammadian-Kalat *et al*. (2017) and material listed below. Note the very wide range for scales around the caudal peduncle is probably indicative of different counting methods.

The sensory canal system was examined in the holotype and 19 paratypes of *P. esfahani*, so the numbers of examined paired canals is 40. The supraorbital canal is not lengthened in its posterior section and has 8-12, commonly 9 or 10 pores (mean 9.6, standard deviation 1.33), with 3 or 4 (3 in 66%) and 5-8 (counts 6 and 7 found each in 30%) canal openings on the nasal and frontal bones, respectively. The infraorbital canal has (14, 15)16-18 pores (a mode of 16 found in 38% of canals, mean 16.6, standard deviation 1.01) with 4 or 5 (in 75%) canal openings on the first infraorbital. The preoperculo-mandibular canal is complete, with 15-17 pores (15 in 58%, 15.5, 0.74) with 4 or 5 (in 83%) and (8)9-10 (9 in 50%) canal openings on the dentary and preoperculum, respectively. It always communicates with the infraorbital canal in the pterotic, passing through the antero-dorsal process of the operculum. The supratemporal canal is complete (60% of specimens) or incomplete, with 4-6 pores. Other osteological characters were given in Coad and Bogutskaya (2010) and Jalili *et al*. (2015) also described the osteology of this species, identified as *A. amirkabiri*.

Sexual dimorphism. Males have a longer dorsal fin base and females a longer anal fin base, possibly associated with pair spawning. Tubercles on two male fish, 79.2-80.5 mm standard length (CMNFI 1979-0245, 9 June 1977) are fine and scattered on the upper head extending down onto the sides of the head but sparser before the eye and in 1-2 rows on the

lower jaw. Fine and numerous tubercles lining scales are prominent on the upper flank and caudal peduncle but become less evident posteriorly and ventrally. Small tubercles are evident on the unbranched and branched dorsal, anal pelvic and pectoral rays, becoming weaker and less extensive to none on the posterior rays.

Colour. Live fish are silvery overall with the head and nape dark dorsally. The back is dark olive-brown to grey with the flank, belly and lower part of the head silvery. Some fish may have an underlying brownish colour. Most fins are clear but the caudal fin in particular having dark pigmentation on the fin rays and with some dark pigmentation on dorsal and pectoral fins. The base of the paired fins is usually orange. There is no distinctive colour pattern in preserved fish. Preserved fish have a pale brown back and upper part of the flank and are yellowish on the lower part of the flank and belly. The lateral stripe is a faint dark grey with hazy margins and runs between the posterior margin of the orbit and the caudal fin base, its width slightly less than the eye pupil diameter. The flank above the lateral line bears a fine dark speckling of melanophores and is mostly unpigmented below the lateral line. There is dark brown speckling along the lateral line above and below pores. Melanophores are present on the upper part of the operculum and extend down along the posterior edge. Melanophores on the cheek ring the lower orbit. Melanophores on the lateral sides of the head are larger and more evident particularly in smaller fish. The back bears a predorsal and postdorsal stripe. The dorsal and caudal fins have very fine melanophores on the rays only. The pectoral fin has similar fine melanophores on its anterior rays only. The anal and pelvic fins are almost unpigmented. The peritoneum is silvery to cream with very few, widely scattered, melanophores, or may appear as a silvery-brown.

Size. Reaches 21.94 cm total length as *Petroleuciscus esfahani* (Alavi-Yeganeh *et al*., 2018).

Distribution. This species is found in the Esfahan, Namak Lake and upper Tigris River basins. In the Esfahan basin it is recorded at Morshid and Roodbar, streams at Damaneh and Dizaj, the Paherahneh qanat, the Zayandeh Reservoir at Chadegan, the Zayandeh River at Azadegan, Cheshmeh-Dimeh, Khersoonak, Chamgordan (= Cham-e Gordan) and Pol-e Safaiyeh, and in the Khorbeh and Mini rivers; in the Namak Lake basin from Emamzadeh (Nazi) Spring in the Qom River basin and the Qareh Chay River at Jalayer, the Morghab Stream and Robat Mahmoud Spring at Golpayegan, at Khomein, the Jaj, Karaj, Kordan and Qom rivers, and at Saveh in Markazi Province; and in the Tigris River basin in the Ab-e Shalamzar, Beheshtabad River, Cheshmeh-Langan, Junaquan and Toof-Sefid rivers, the Shahr-e Kord Stream and Spring and at Ghale Shahrokh and Iskandari (Pelasegan) (Coad and Bogutskaya, 2010; Dorofshan *et al*., 2015; Mohammadian-Kalat *et al*., 2017; Alavi-Yeganeh *et al*., 2018; Pishkahpour *et al*., 2019a; Eagderi *et al*., 2020; Jouladeh-Roudbar *et al*., 2016, 2020).

Shojaee *et al*. (2014) gave several localities in the Zayandeh River above and below the dam, and also mentioned the Karun River incorrectly based on Coad and Bogutskaya (2010).

Zoogeography. This species is morphologically closest to *A. ulanus* of the Lake Urmia basin.

Habitat. This species is found in rivers, streams, springs and qanats. Habitat data based on the type locality of *Petroleuciscus esfahani* showed a fresh, clear stream at an altitude of 2,300 m. Water temperature at 1705 hours on 9 June was 22°C, pH was 6.2, conductivity was 0.455 mS, stream width was 2-8 m, maximum depth was 1 m, current was slow to moderate, aquatic plant material was of the submergent type, the shore was grassy, and the stream bottom was a mix of pebbles and mud. *Capoeta coadi* was also caught. The second locality was a fresh stream with clear water at an altitude of 2,410 m. Water temperature at 1225 hours on 10 June

was 17°C, pH was 6.2, conductivity was 0.4 mS, stream width was 4.0 m, maximum depth was 70 cm, current was slow to moderate, aquatic plant material was of the encrusting type, the shore was grassy, and the stream bottom was a mix of pebbles, sand and mud. Other collection data included a temperature range of 17-25ºC, pH 6.2-6.5, conductivity 0.35-1.85 mS, river width 2.5-80.0 m, slow to fast current, river depth 50-150 cm, capture depth 75-150 cm, clear to cloudy water, mud, sand, pebbles or stone bottoms, encrusting, submergent and emergent vegetation, and a grassy or forested shore.

Habitat of *Alburnus doriae*, Markazi, Qareh Chay at Jalayer, Arash Jouladeh-Roudbar.

Age and growth. Alavi-Yeganeh *et al*. (2018) examined 85 fish identified as *Petroleuciscus esfahani*, 2.82-21.94 cm total length, from the Cheshmeh-Langan River and found a *b* value of 3.176 showing positive allometric growth. Eagderi *et al*. (2020) examined 28 fish, 7.7-14.15 cm total length, from the Toof-Sefid River, Chahar Mahall and Bakhtiari and found a *b* value of 3.04, isometric growth. Zare-Shahraki *et al*. (2020) measured 145 fish, 4.0-16.3 cm total length, from the Karun River system and recorded a *b* value of 3.11.

Food. Food is mainly aquatic invertebrates and insects.

Reproduction. Unknown.

Parasites and predators. Fish from CMNFI 1979-0259 have black spots, possibly encysted trematode larvae.

Economic importance. None.

Experimental studies. Dorofshan *et al*. (2015) found levels of cadmium and chromium increased downstream in fish identified as *Petroleuciscus esfahani* from the Zayandeh River and levels were higher than international standards at all stations. Raki *et al*. (2015, 2015) showed that silver nanoparticles and silver nitrate had adverse effects on haematological indices, and caused lesions in gill and liver tissues of fish identified as *Petroleuciscus esfahani*. Gilannejad *et al*. (2016) examined vitellogin expression as a measure of endocrine disrupting chemicals in sites

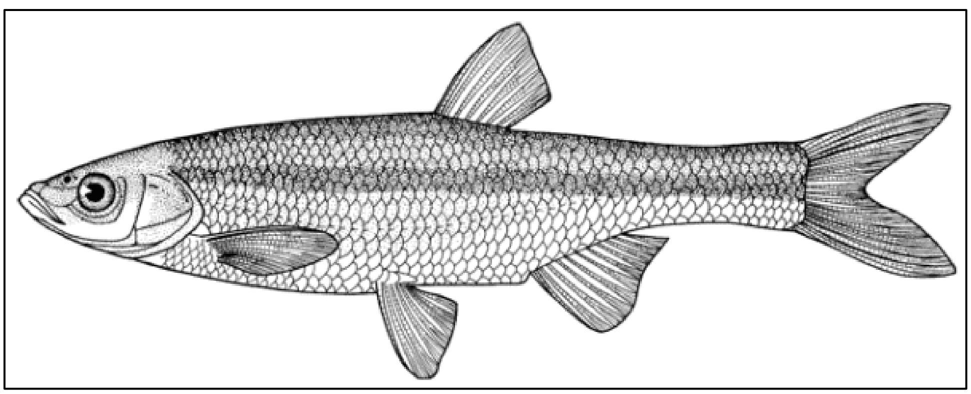
up- and downstream of a major pollution source (a steel mill plant) in fish identified as *Petroleuciscus esfahani* from the Zayandeh River and found a higher vitellogin expression in males with reduced gonad size and condition factor downstream from the steel mill.

Conservation. Dam construction on the Zayandeh River may have altered the ecology of that river system, exacerbated by population growth and its demands on limited water resources in a desert environment. However, the species may be relatively secure in higher tributary streams. It is now known from three basins, has large population sizes and lack of any particular threats leading Jouladeh-Roudbar *et al*. (2020) to list it as of Least Concern.

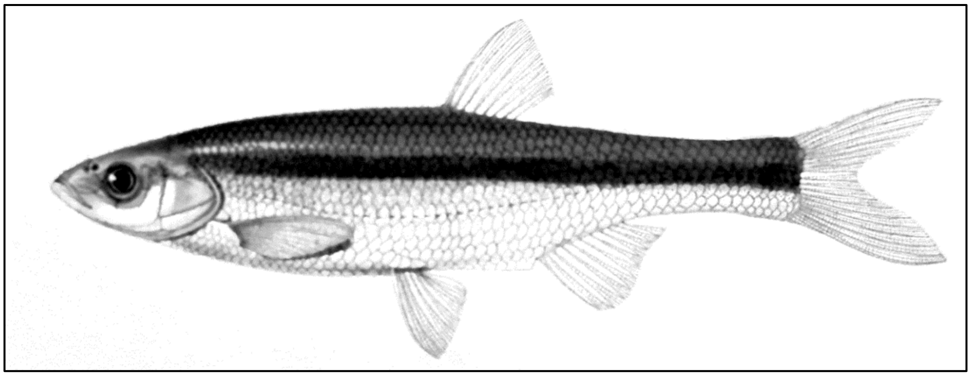
Sources. Type material:- *Alburnus doriae* (MZUT N.720) and *Petroleuciscus esfahani* (CMNFI 1979-0249 and CMNFI 1979-0251).

Iranian material:- CMNFI 1979-0243, 18, 26.1-48.7 mm standard length, Esfahan, Zayandeh River at Falavarjan (32º33'N, 51º31'E); CMNFI 1979-0244, 3, 60.6-74.6 mm standard length, Chahar Mahall and Bakhtiari, spring at Shahr Kord (32º19'N, 50º52'E); CMNFI 1979-0245, 125, 31.6-100.6 mm standard length, Chahar Mahall and Bakhtiari, stream in Ab-e Shalamzar drainage (Khersan River basin) (32º08'N, 50º51'E); CMNFI 1979-0250, 28, 26.3-88.4 mm standard length, Esfahan, stream at Damaneh (33º01'N, 50º29'E): CMNFI 1979-0253, 5, 47.6-77.0 mm standard length, Qom, river in Qareh Chay drainage (34º52'N, 50º49'E); CMNFI 2007-0072, 15, 55,6-84.0 mm standard length, Esfahan, Paherahneh qanat (ca. 32º43'N, ca. 52º40'E); CMNFI 2007-0073, 10, 43.0-74.1 mm standard length, Esfahan, Zayandeh River at Tanderan (32º47'N, 51º02'E); CMNFI 2007-0077, 10, 47.1-100.0 mm standard length, Markazi, Qom River (ca. 34º18'N, 50º32'E).

Alburnus filippii
Kessler, 1877



Alburnus filippii
Susan Laurie-Bourque @ Canadian Museum of Nature.



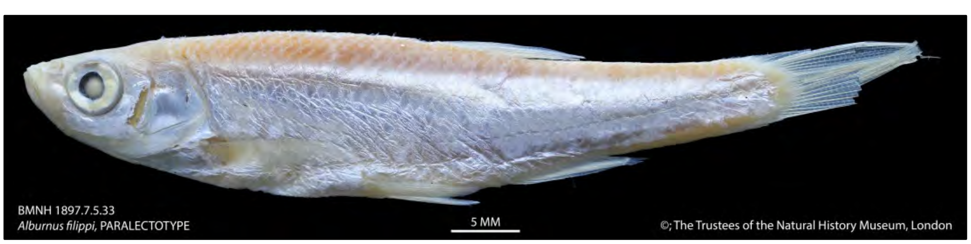
Alburnus filippii, 14.2 cm total length, ZISP 14722
(the last 2 in the catalogue number is missing from the illustration in Berg),
Turkey, Merdenek, a tributary of Lake Chaldyr-gel' (= Çıldır) in the Aras River basin,
after Berg (1948-1949).

Alburnus filippii, Iran, Qareh Su, Aras River basin, January 2011, Keyvan Abbasi.

Common names. Kuli-ye Kura (= Kura River fish), mahi morvarid or morvarid mahi (= pearl fish).

[Kur kumuscasi in Azerbaijan; Kura incisi and İnci balığı in Turkish (Çiçek *et al*., 2020; Kaya *et al*., 2020); Kurinskaya ukleika or Kura bleak, ukleika filippi or Filippi's bleak, both in Russian].

Systematics. The lectotype of *Alburnus Filippii* as designated by N. Bogutskaya is in the Zoological Institute, St. Petersburg (ZISP 2926) and is from "Fl. Kura pr. Tiflis", Acad. Brandt, 1867, 75.3 mm standard length. Paralectotypes are ZISP 2925, 13 fish, same data as lectotype, 43.0-84.4 mm standard length, ZISP 2914, 2 fish, "Fl. Kura pr. Borshoma", Acad. Brandt, 1867, 83.6-87.6 mm standard length, and ZISP 50412, 16 fish, "Reka Kura Tiflis", Acad. Brandt, 1867, 60.6-88.6 mm standard length. A syntype or paralectotype, 57.3 mm standard length, is in the Natural History Museum, London from Tiflis (BM(NH) 1897.7.5:33, formerly in ZISP).



Alburnus filippii, paralectotype, BM(NH) 1897.7.5:33.

Alburnus filipii var. Kessler in Brandt, 1880 from the Tchaldyr Lake (= Çıldır in Turkey) is also this species. Knipovich (1921) reported a Caspian basin species "*Alburnus philippii*" Kessler which is presumably a misspelling of *filippii*. The specific name is sometimes spelt *filippi*, which is incorrect.

Abdurakhmanov (1962) compared a sample from the Kura River basin with one from the Kendalanchaya in the Aras River basin of Azerbaijan and found 15 characters were significantly different on average. Fish from the Kura had a longer head, greater dorsal and anal fin heights, and longer pectoral, pelvic and upper and lower caudal fin lobes while fish from the Aras had more scales in the lateral line, a deeper head, body and caudal peduncle, and a longer anal fin base, pectoral-pelvic fin distance and snout, and a greater interorbital width. No taxonomic status was assigned to these two populations. Jalili *et al*. (2015) found fish from the mainstream Aras River showed more morphological variation than those from the tributary Ahar Chay indicating availability of more diverse habitats. Differences included a form with a more elongate body in the Aras presumably associated with stronger water current and a relatively upturned mouth associated with surface feeding.

A hybrid with *Alburnus charusini hohenackeri* (= *Alburnus hohenackeri*) was reported by Petrov (1926) from the Sefid River and the Kumbashinka in Lenkoran.

Key characters. This species is distinguished from its relative (*Alburnus chalcoides*, also with a long, naked ventral keel) and other *Alburnus* in Iran by having modally 7 dorsal fin branched rays and generally lower anal fin ray counts although these do overlap (10-21, usually 14-15 in Iran for *chalcoides*; 9-13, usually 10-12, for *filippii*).

Morphology. The body is moderately elongated, compressed and moderately deep. It is deepest at the pectoral fin level. The predorsal profile is slightly convex to almost straight. The caudal peduncle is compressed and moderately deep. The head tapers to pointed snout. The eye is partly in the posterior half of the head or at the beginning of the anterior half. The mouth is oblique and extends back to the end of the nostril level. The snout tip is at the level of the upper third of the eye or almost its upper margin. The lower jaw projects a little. Lips are thin. The dorsal fin margin is straight to slightly rounded. The dorsal fin origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the middle of the anal fin. The caudal fin is moderately forked with pointed tips. The anal fin is slightly emarginate and does not extend back to the caudal fin base. The pelvic fin is rounded and does not reach back to the anus or reaches the anterior edge of the anal papilla. The pectoral fin is rounded and almost reaches back to the pelvic fin origin or falls short.

Dorsal fin with 3 unbranched and 6-8, usually 7, branched rays, anal fin with 2-3, usually 3, unbranched and 9-13 branched rays, usually 10-12, pectoral fin branched rays 12-16, and pelvic fin branched rays 6-8, usually 7. Lateral line scales 46-64. Counts by Khataminejad *et al*. (2016, 2017) agree with this summary. There is a large pelvic axillary scale. Scales have an overall vertical oval shape, sometimes tapering to a rounded posterior point and sometimes more rounded, a wavy anterior margin, few anterior and posterior radii, and a subcentral anterior focus. The naked ventral keel usually extends more than half way from the anal papilla to the pelvic fin insertion but is often completely scaled, notably in fish from the Sefid River basin. Total gill rakers number 12-21, reaching the second or third adjacent raker when appressed. Pharyngeal teeth are 2,5-5,2 (but see below for Iranian specimens) with variants 2,5-5,1, 1,5-5,2, 1,5-5,1, 2,5-4,2, 2,4-5,2, 2,5-4,1, 2,4-4,2, 1,5-4,1, 1,4-5,1, and 1,5-4,2. Teeth are strongly hooked and strongly serrated. Serrations are on the anterior margin of each tooth. The degree of hook and serration development varies individually and does not seem to be size related. Some fish

have little development of either character. The area below the hook is an elongate, flat to concave surface. The gut is an elongate s-shape with a small anterior loop. The gas bladder has a rounded end in contrast to the pointed end in *Alburnus chalcoides*. Total vertebrae number 38-43. The chromosome number is 2n = 50 and Nazari *et al*. (2009, 2011) gave further details.

The skeletal structure of this species is described by Nikmehr *et al*. (2017).

Meristic values for Iranian specimens are:- dorsal fin branched rays 6(1), 7(44) or 8(5), anal fin branched rays 9(1), 10(19), 11(24), 12(5) or 13(1), pectoral fin branched rays 12(3), 13(19), 14(20), 15(7) or 16(1), pelvic fin branched rays 6(3), 7(42) or 8(5), lateral line scales 46(1), 47(-), 48(-), 49(1), 50(5), 51(5), 52(4), 53(12), 54(5), 55(2), 56(5), 57(6), 58(1), 59(-), 60(2), 61(-), 62(-) or 63(1), total gill rakers 12(4), 13(8), 14(19), 15(10), 16(6) or 17(3), pharyngeal teeth 2,5-4,2(10), 2,4-5,2(2), 2,4-4,2(2), 2,5-5,2(1), 1,5-4,2(2), 1,5-5,2(1), 1,5-4,1(1) or 1,4-5,1(1), and total vertebrae 38(2), 39(8), 40(18), 41(9) or 42(1).

Sexual dimorphism. Males and females have moderate-sized tubercles widely scattered on the top of the head, on the snout and lining the lower edge of the jaw. Much smaller tubercles are scattered among the ones on top of the head.

Colour. The back is brown, flanks silvery and the belly white. A characteristic dark streak, as wide as the eye, runs along mid-flank. Fins are hyaline. The peritoneum is brown or light with large scattered melanophores.

Size. Reaches 17.0 cm standard length.

Distribution. Found only in the Caspian Sea basin from the Kura River of Azerbaijan to the Sefid River of Iran including headwaters in Turkey, Armenia and Iran at altitudes over 3,000 m. It is distributed in the Ahar, Aras, Babol, Baleqlu, Chaysalman, Chelond, Chelvand, Chobar, Ghori, Lomir, Marbureh, Pir Bazar, Qarangho, Qareh Su, Qezel Owzan, Sefid, Shah, Shalman, Sheikan, Siah Darvishan, Sowsar, Tootkabon (= Tutkabon) and Zanjan rivers, the Anzali Talab, and the Golabar, Manjil, Nazdik, Sattarkhan, Taham and Zire dams (Holčík and Oláh,1992; Abbasi *et al*., 1999, 2007, 2017; Karimpour, 1998; Kiabi *et al*., 1999; Abdoli and Naderi, 2009; Hajirostamloo, 2009; Mirzajani, 2010; Mirzajani *et al*., 2012; Jalali Roshan *et al*., 2013; Khataminejad *et al*., 2013b, 2015, 2017; Jalili *et al*., 2015; Asadi *et al*., 2016; Babaei, 2017; Mohammadian-Kalat *et al*., 2017; Nikmehr *et al*., 2017; Shahnazari *et al*., 2020; Aazami and Alavi Yeganeh, 2021). Esmaeili *et al*. (2018) stated that it is known only from the Aras and Sefid rivers and the Anzali Lagoon.

Records from the Talkheh (= Aji) River (Lake Urmia basin) and the Sirvan River (Tigris River basin) are presumably mis-identifications (Mohammadian-Kalat *et al*., 2017; Hasankhani *et al*., 2019) but may be introductions.

Zoogeography. The relationships of this species with other *Alburnus* need to be examined. It presumably originated as part of a Sarmatian fauna, isolated in the Caspian Sea.

Habitat. This species is found in rivers, streams, dams, lagoons, marshes and brackish environments. Primarily a freshwater species, this minnow may be found in the brackish outlets of the Anzali Talab (Holčík and Oláh, 1992). Naderi Jolodar and Abdoli (2004) noted that it is found more in upstream waters than *A. alburnus* (*sic*, presumably *A. hohenackeri*). Collection data included a temperature range of 5.6-25.5ºC, pH 6.2, conductivity 1.5-1.95 mS, river width 10-100 m, slow to fast current, depth up to 100 cm, clear or muddy water, mud, clay, sand, gravel, pebble or stone bottoms, encrusting vegetation, and a bushy or grassy shore.

Age and growth. Life span is about 5 years with maturity at 1 year for males and 2 years for females. Hasankhani *et al*. (2013) gave a *b* value of 3.382 (in the Abstract, or 3.384 in a table) for 81 fish, 5.2-15.03 cm total length, from the Sirvan River (Tigris River basin) but this is

presumably a misidentification. Mousavi-Sabet *et al*. (2014) gave a *b* value of 3.115 for 30 fish, 78.5-107.79 mm total length, from the Baleqlu River.

Food. Gut contents include plant remains, mayflies and algae in Azerbaijan (Abdurakhmanov, 1962). Iranian specimens examined by me contained insect remains, a few crustaceans and sand grains. One sample from the Qareh Su north of Ardabil had been feeding on water beetles (Hydrophilidae) but also spiders and scarab beetles (*Euoniticellus* sp.) indicating food could also be taken from the surface.

Reproduction. Eggs number reach up to 14,210 and diameters up to 1.51 mm. May is the principal spawning month in Azerbaijan (Abdurakhmanov, 1962). A male fish caught on 6 June 1978 (70.9 mm standard length, CMNFI 1979-0448) in Iran had tubercles scars on top of the head while female fish from another locality taken on 8 June 1978 (73.3 mm standard length, CMNFI 1979-0453) had mature eggs measuring 1.2-1.3 mm. Spawning probably occurs in May and June in Iran, depending on local conditions.

Parasites and predators. Mortazavi Tabrizi *et al*. (2005) recorded *Ligula intestinalis* and *Bothriocephalus acheilognathi* in this species from the Sattarkhan Dam in East Azarbayjan, the former also recorded by Hajirostamloo (2009). Pazooki *et al*. (2005) recorded *Trichodina perforata* from this species in waterbodies of Zanjan Province and Pazooki *et al*. (2006) the monogeneans *Dactylogyrus vistulae* and *Gyrodactylus* sp. in Zanjan Province fish.

Undoubtedly food for various predatory fishes.

Economic importance. None.

Experimental studies. None.

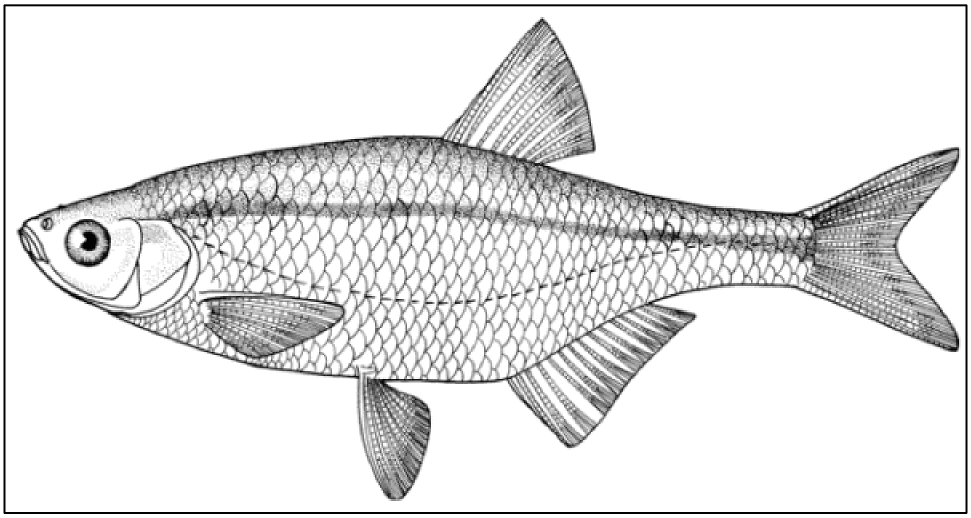
Conservation. Kiabi *et al*. (1999) considered this species to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included medium numbers, habitat destruction, medium range (25-75% of water bodies), absent in other water bodies in Iran, and absent outside the Caspian Sea basin. Mostafavi *et al*. (2018) modelled the distribution of this species in all climatic scenarios and found 100% reduction on two temporal scales (2050 and 2080) with no new potential areas available. Vulnerable in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Type material:- ZISP 2914, ZISP 2925, ZISP 2926, ZISP 50412 and BM(NH) 1897.7.5:33.

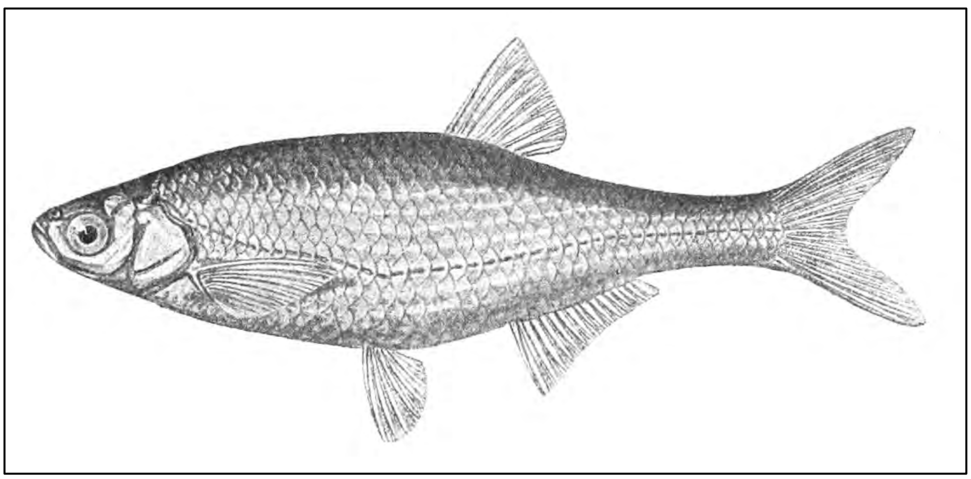
Iranian material:- CMNFI 1970-0516, 10, not kept, Gilan, Lomir River (38º14'N, 48º52'30"); CMNFI 1970-0519, not kept, Gilan, Chelvand River (ca. 38º18'N, ca. 48º52'E); CMNFI 1970-0522, 1, 49.5 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0538, 8, 34.9-61.8 mm standard length, Gilan, Qezel Owzan River above Manjil Dam (ca. 36º44'N, 49º24'E); CMNFI 1979-0448, 1, 70.9 mm standard length, Ardabil, Ahar Chay 8 km from Ardabil (38º18'30"N, 48º22'E); CMNFI 1979-0452, 2, 52.4-54.9 mm standard length, East Azarbayjan, Qezel Owzan River 6 km from Mianeh (37º23'N, 47º45'E); CMNFI 1979-0453, 9, 43.7-73.3 mm standard length, Zanjan, Zanjan River (37º06'N, 47º56'E); CMNFI 1979-0455, 17, 42.8-62.5 mm standard length, Qazvin, Manjil Dam (36º45'N, 49º17'E); CMNFI 1979-0695, 3, 61.3-63.5 mm standard length, Gilan, Sefid River at Manjil Bridge (36º46'N, 49º24'E); CMNFI 2007-0081, 1, 51.0 mm standard length, Zanjan, Zanjan River near Soltaniyeh (ca. 36º27'N, ca. 48º45'E); CMNFI 2007-0082, 11, 41.2-59.6 mm standard length, Zanjan, Zanjan River basin near Zanjan (ca. 36º36'N, ca. 48º32'E); CMNFI 2007-0087, 6, 55.7-83.1 mm standard length, Ardabil, Qareh Su north of Ardabil (38º22'N, 48º19'E); CMNFI 2007-0089, 1, 33.5 mm standard length, East Azarbayjan, Ahar Chay at Ahar (38º28'N, 47º03'E); CMNFI 2007-0106, 16, 50.3-93.0 mm standard length, Kordestan, Qezel

Owzan River near Divandarreh (ca. 35º52'N, 47º05'E); CMNFI 2007-0107, 3, 41.1-42.3 mm standard length, Kordestan, Qezel Owzan River basin near Bijar (ca. 35º54'N, ca. 47º20'E).

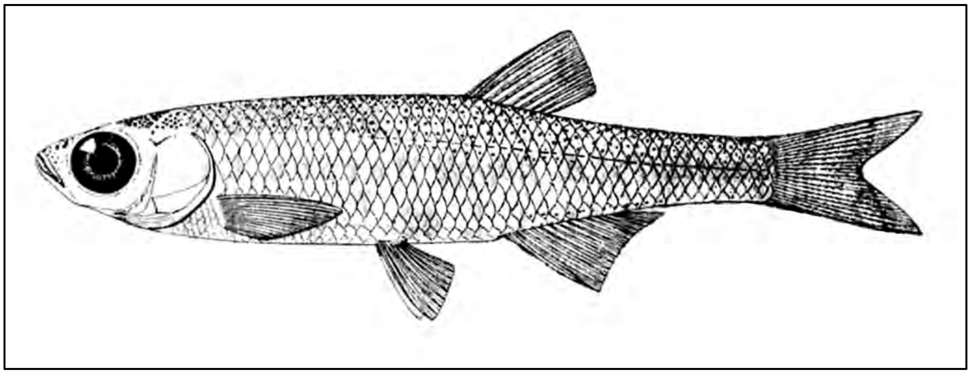
Alburnus hohenackeri
Kessler, 1877



Alburnus hohenackeri
Susan Laurie-Bourque @ Canadian Museum of Nature.



Alburnus hohenackeri (as *A. charusini*), Russia, Terek River at Chervlenaya, after Berg (1916).



Alburnus hohenackeri fry, 33 mm total length, Kazakhstan, Ural River delta (after Berg, 1932b).

Alburnus hohenackeri, Gilan, Anzali Wetland, November 2011, Keyvan Abbasi.

Alburnus hohenackeri, Khuzestan, Marun River, Kai Borkenhagen.

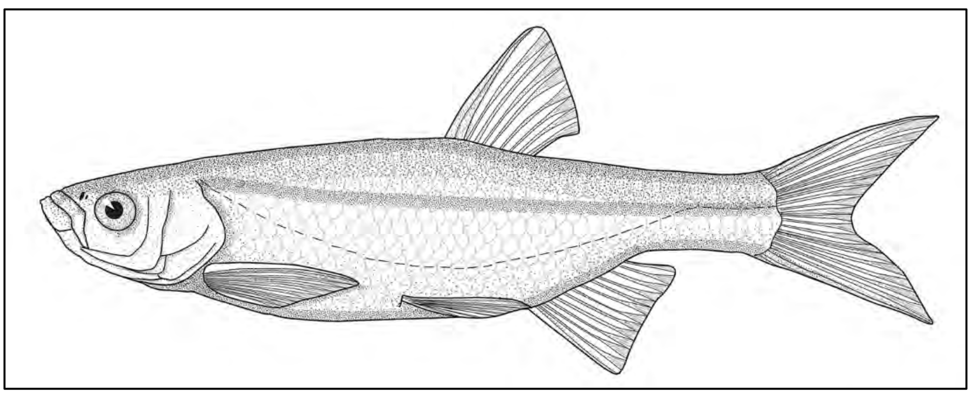
Common names. Kuli (= general term for a small fish), kuli-ye Irani (= Iranian fish), mahi morvarid or morvarid mahi (= pearl fish).

[Simali gafgaz kumuscasi for *A. c. charusini* or zagafgaziya kumuscasi for *A. c. hohenackeri*, both in Azerbaijan; Hazar Denizi incise in Turkish (Kaya *et al*., 2020); ukleika or bleak, persidskaya ukleika or Persian bleak, sefidrudskaya ukleika or Sefid River bleak, zakavkazskaya ukleika or Transcaucasian bleak, all in Russian; Caucasian bleak (as *A.*

hohenackeri)].

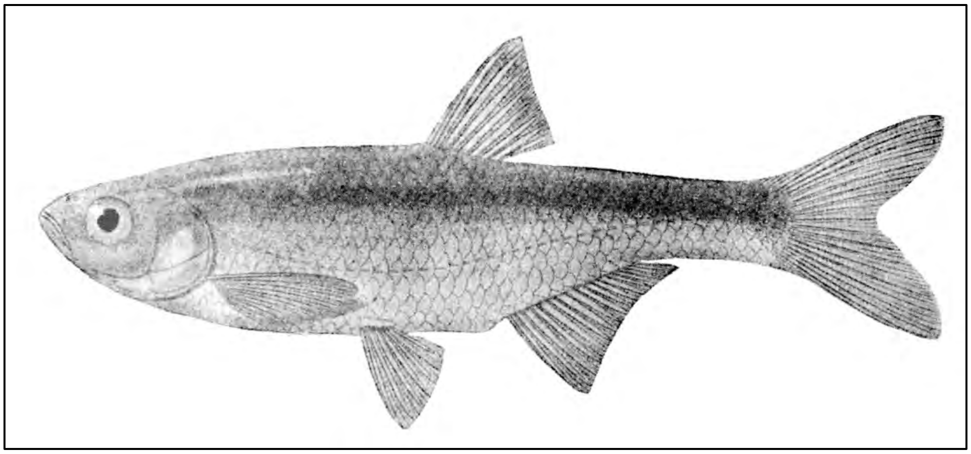
Systematics. *Alburnus Hohenackeri* was originally described from Karabakh, Azerbaijan, on the Kura River. The taxon in Iran was formerly included within the wide-ranging species *Alburnus alburnus* (Linnaeus, 1758). *Cyprinus Alburnus* was originally described from Europe.

A synonym common in older literature is *Alburnus charusini* Herzenstein in Zograff and Kavraiskii, 1889 described from the Maly Uzen River mouth and Kamysh-Samarskie lakes between the Volga and Ural rivers in Kazakhstan. *Alburnus alasanicus* Kamensky, 1901 from the Alasan, Alazan' or Alazani River, a left bank Kura River tributary in Georgia is a synonym of *Chondrostoma oxyrhynchum* Kessler, 1877 (*Catalog of Fishes*, downloaded 30 May 2018) despite being described in *Alburnus*. Other synonyms are *Alburnus lucidus* var. *macropterus* Kamensky, 1901 described from the Alazan' River, Georgia (no types known), *Alburnus alburnus charusini* natio *elata* Petrov, 1926 from the Prorva River (lower reaches of the Terek River), the Sulak River and the Divichi Liman, western Caspian Sea (not available, infrasubspecific, no types listed in the *Catalog of Fishes*, downloaded 30 May 2018), *Alburnus striatus* Petrov, 1926 from "Kizil-Agachskogo Zaliva" (Kizil-Agach Bay, Turkmenistan) and "Astrabadskogo Zaliva" (= Astrabad or Gorgan Bay, Iran) (syntypes exist but deposition is not given in the *Catalog of Fishes*, downloaded 30 May 2018, presumably the Bakinskoi ikhtiologicheskoi laboratorii, Baku, Azerbaijan), and *Alburnus alburnus* natio *dagestanicus* Petrov, 1930 (*sic*) but later in the same paper given, and probably originally meant, as *A. a. charusini* n. *dagestanicus*) described from the "Kaukasusküste des Kaspische Meeres" (not available, infrasubspecific, no types listed in the *Catalog of Fishes*, downloaded 30 May 2018).



Alburnus striatus, after Petrov (1926),
re-drawn by Susan Laurie-Bourque @ Canadian Museum of Nature.

Alburnus pseudospirlinus Petrov, 1926 from "Novaya Rechkaya (nizov'ya Sefid-Rud)" (= new stream, lower Sefid River) is a hybrid of this species and *Alburnoides bipunctatus* (*sic*, presumably *A. samiii*) according to Berg (1948-1949) (13 syntypes exist but deposition not listed in the *Catalog of Fishes*, downloaded 30 May 2018, presumably the Bakinskoi ikhtiologicheskoi laboratorii, Baku, Azerbaijan). A hybrid with *Alburnus filippii* was described from the Kumbashinka River in the Lenkoran and from the Sefid River (Petrov, 1926).



Alburnus pseudospirlinus, 7.5 cm total length, ZISP 20864, Gilan, Sefid River, after Berg (1948-1949).

The holotype of *Alburnus hohenackeri* is in the Zoological Institute, St. Petersburg (ZISP 2339). The holotype of *Alburnus charusini* is in the Zoological Museum of Moscow State University under MMSU P.1314. Four fish are listed as questionable syntypes under MMSU P.1812 by Svetovidova (1978) although according to Eschmeyer *et al*. (1996) the original says P.1314 with a unique holotype only.

This species was long recognised as *Alburnus charusini* in Iran but characters overlap with *Alburnus alburnus*, a highly variable species (Gäsowska, 1974). In any case *hohenackeri* has priority over *charusini*. Literature sources conflicted on the correct name. Petrov (1926, 1930) referred to *Alburnus alburnus hohenackeri* Kessler, 1877 for fish in northern Iran with natio *persicus* Petrov, 1926 in the Sefid River, natio *dagestanicus* Petrov, 1930 in the Dagestan area of Azerbaijan and natio *kumbashensis* Petrov, 1926 from the Kumbashinka River and Lake Ol'khovskoye in the Lenkoran area of Azerbaijan. Natio are not recognised by the Zoological Code of Nomenclature (Ride *et al*., 1985). Liška and Pivnička (1985) referred southern and southeastern populations of this species to *Alburnus alburnus albidus* Costa, 1838, and this would include the Iranian populations. These fish are separated from the type subspecies by having 39-47 lateral line scales, most frequently 42-44 (44-54, most frequently 47-50 in *A. a. alburnus*), anal fin branched rays 10-17, most frequently 13-15 (14-21, most frequently 16-19), and head length as per cent of body length 22-27 most frequently 23-25 (19-25, most frequently 21-23). N. Bogutskaya (pers. comm., 1995) and Reshetnikov *et al*. (1997) referred Iranian fish to *Alburnus alburnus hohenackeri* as there is a definite character break at the Terek River separating northern populations from southern ones. Petrov (1930) came to a similar conclusion on the name of the Iranian populations in his study as noted above. Aburakhmanov (1962) too referred the taxon *hohenackeri* to fish found in the Kura and Aras rivers and in rivers of the Lenkoran coast (and presumably the Iranian coast) while his *charusini* are north of the Apsheron Peninsula. Bogutskaya and Naseka (2004) and Kottelat and Freyhof (2007) recognised *A. hohenackeri* as a distinct species.

Key characters. This species can be confused with *Alburnoides* spp. which are superficially similar in scale and fin ray counts. A key distinction is the total gill raker count of 15-29 (usually 20 or more) in this species as opposed to 5-12, usually 7-10 in *Alburnoides* species. *Alburnus* rakers are more than twice as long as those in *Alburnoides* and, being more numerous, are crowded on the arch without the large gaps between individual rakers which characterise *Alburnoides*. It is distinguished from other Caspian Sea species by having modally 8

branched dorsal fin rays, 34-55 (mostly 45 or less) lateral line scales, a mostly naked abdominal keel, and a light silvery peritoneum.

Morphology. The body is compressed and moderately deep, being deepest midway between the dorsal fin origin and the end of the head. The predorsal profile is convex. The caudal peduncle is compressed and moderately deep. The snout is gently rounded to pointed and the lower lip protrudes. The rear of the eye is at the beginning of the anterior half of the head. The mouth is very oblique with its tip almost at the level of the upper eye margin and it extends back to the level of the anterior nostril. Lips are thin. The dorsal fin margin is straight. The dorsal fin origin is over the rear of the pelvic fin or just past its middle. The depressed dorsal fin extends back level with the middle of the anal fin. The caudal fin is moderately forked with pointed to rounded tips. The anal fin is emarginate and does not extend back to the caudal fin base. The pelvic fin is rounded and does not extend back to the anus or just reaches the anterior part of the anal papilla. The pectoral fin is rounded and does not reach back near to the pelvic fin or almost reaches it.

Dorsal fin with 2-4 unbranched rays and 7-9 branched rays, usually 8, anal fin unbranched rays 3-4 and branched rays 10-16, pectoral fin branched rays 11-16, and pelvic fin branched rays 6-9. Lateral line scales 34-55, mostly 45 or less. Scale shape is oval with the posterior margin protruding, rounded dorsal and ventral margins and anterior corners, and an anterior margin with a central protrusion and an indentation above and below. Or, shape is more squarish with a rounded posterior margin, straight or slightly rounded dorsal and ventral margins, and an anterior margin with a central protrusion and indentations on each side or wavy and irregular. Overall, scale shape is very irregular, even among adjacent scales. Scales bear both anterior and posterior radii with a few curved radii in the lateral fields. The focus is subcentral anterior and circuli are numerous and fine. The naked ventral keel is often wholly or partially covered by scales. There is a long pelvic axillary scale. Total gill rakers number 15-29 (possibly including some lower arch only counts - but see below), and are dense and elongate reaching the third, or rarely second, below when appressed. Pharyngeal teeth are 2,5-5,2 with variants 2,5-5,1, 2,5-5,3, 1,5-5,2, 1,5-5,1, 2,5-4,2, 2,4-5,2, 2,4-5,1, 2,4-4,2, 1,5-4,2, 2,5-4,1, 1,5-4,1, 1,4-4,1. The elongate and narrow teeth bear a strongly hooked tip and have evident serrations in most specimens although some lack them entirely. The gut is an elongate s-shape with a small anterior loop. The posterior end of the gas bladder is rounded (pointed in *Alburnus chalcoides*). Total vertebrae number 36-46, a very wide range from literature, see below. The chromosome number is 2n = 50-52, generally 50 (Klinkhardt *et al*., 1995).

The natio *persicus* from the Sefid River has dorsal fin branched rays 7-9, anal fin branched rays 12-16 and lateral line scales 40-45. Fish from the Kura-Aras basin and Lenkoran (*hohenackeri*) have anal fin branched rays 10-15, lateral line scales 38-48, pharyngeal teeth 2,5-5,2, total gill rakers 16-25 and total vertebrae 37-42 (courtesy of N. Bogutskaya, Zoological Institute, St. Petersburg).

Meristic values for Iranian fish including Petrov's (1930) counts of dorsal and anal branched rays and lateral line scales for Sefid River fish are:- dorsal fin branched rays 7(7), 8(76) or 9(8), anal fin branched rays 12(6), 13(37), 14(28), 15(16) or 16(2), pectoral fin branched rays 12(2), 13(18), 14(17) or 15(3), pelvic fin branched rays 7(11) or 8(29), lateral line scales 39(2), 40(8), 41(10), 42(28), 43(13), 44(9), 45(7), 46(1), 47(1), 48(1), 49(-) or 50(1), total gill rakers 19(1), 20(2), 21(18), 22(7), 23(5), 24(4) or 25(3), pharyngeal teeth 2,5-5,2(13), 2,5-4,2(11), 2,5-4,1(1), 2,4-5,2(2) or 2,4-4,2(1), and total vertebrae 37(2), 38(24), 39(20), 40(7) or 41(1). Khataminejad *et al*. (2013) gave meristic values in line with those above for fish from the

Mahabad River in the Lake Urmia basin (presumably introduced) except for having 8-10 anal fin branched rays - the identity of these fish needs verification.

Sexual dimorphism. Tubercles line the edge of each scale and in single file line the rays of all fins. Fine tubercles cover the whole head.

Colour. The overall colour is bright silvery with the posterior scale margins grey on the upper flank. The back is dark blue to olive or bluish-green and is sharply distinct from the lighter flanks. The mid-line of the back has a narrow dark line. The lateral line and the area above it have some pigmentation, concentrated along the lateral line itself, but there is no dark stripe or it is only faintly developed and is bluish or greyish. Above this stripe is an iridescent golden-green stripe only visible at a certain angle. The bluish or greyish stripe is more evident in preserved material. The belly and lower head surface are pearly-white. The iris is silvery with a yellow ring along the outer eye rim but very little around the pupil. The upper part of the iris may have some dark pigment. The dorsal and caudal fins have dark rays and transparent membranes but may be a dirty yellow. Membranes may have some pigment, particularly on the dorsal fin. The upper anterior edge of the pectoral fin has a little dark pigment while the rest of the fin is colourless to grey or orange. Some fish have a yellow base to the pectoral fin. The pelvic and anal fins are usually colourless, although the anal rays may have some grey or there may be some yellow, orange or red on the fin generally. The caudal fin tip is dark grey.

In preserved fish, most flank pigment is above the lateral line. Lateral line scales have pigment both above and below the pore so the pore stands out. This is not as distinctive as in some *Alburnoides* spp. A mid-dorsal stripe is more evident in smaller fish and is obscured by the generally darker back and upper flank pigmentation in larger fish. A flank stripe may be developed although not as strongly as in *Alburnus filippii*; the stripe is more a darker area along the muscle mass divide between a lighter upper flank and lower flank. The peritoneum is a light silvery with scattered melanophores.

Size. Reaches 10.6 cm.

Distribution. This species is found in the Caspian Sea basin including along the Iranian coast. It is reported from the Aras, Babol, Baleqlu, Feryedun Kenar, Golshan, Gorgan, Harisak, Haraz, Haviq, Kargan, Kia, Langarud, Lashtenesha (= Lasht Nesha'), Masoleh, Nahang, Nerissi, Nesa, Pir Bazar, Polrud (= Pol-e Rud), Qareh Su, Qezel Owzan, Rasteh, Sardab, Sefid, Shafa, Shah, Shalman, Shesh Deh, Shirud, Siah, Siah Darvishan, Sorkh, Tajan, Talar, Tonekabon and Zarrin Gol rivers, the Aliabad, Voshmgir and Zire dams, possibly the Golabar Dam, and the Anzali Talab (Derzhavin, 1934; Holčík and Oláh, 1992; Karimpour, 1998; Kiabi *et al*., 1999; Abbasi *et al*., 1999, 2007, 2017; Nasrollahzadeh, 1999; Abdoli and Naderi, 2009; Ahmadpour *et al*., 2012; Jafarzadeh *et al*., 2015; Khataminejad *et al*., 2015; Babaei, 2017; Mohammadian-Kalat *et al*., 2017; Naderi Jolodar *et al*., 2017; Shahnazari *et al*., 2020).

Also widely introduced across western, central and eastern Iran, including in the Sirvan River in the upper Diyala River, the Beheshtabad River in the upper Karun River basin, the Marun River (K. Borkenhagen photograph, see above), the Miriseh River, Lake Zaribar and Choghakor (= Chagha Khur) Wetland in the Tigris River basin (Raissy *et al*., 2010); the Aji, Mahabad, Qader and Shahr rivers in the Lake Urmia basin (Ghasemi *et al*., 2015; Mohammadian-kalat *et al*., 2015, 2017); the Zayandeh River of the Esfahan basin; the Jajarm, Kal-e Shur and Qareh Su rivers of the northeastern Dasht-e Kavir basin; the Doosti and Kardeh dams in the Hari River basin and the Hari River (Mohammadian-kalat *et al*., 2015; Asgharnia *et al*., 2018; Mousavi-Sabet *et al*., 2018); and in the Hamun Kushk, Chahnimeh Reservoirs, and Kahak and Sistan dams of the Sistan basin; and possibly in the Minab (= Esteghlal) Dam of the

Hormozgan basin (A. Abdoli, pers. comm., 1995; J. Holčík, *in litt*., 1996; Abdoli, 2000; Ghorbani Chafi, 2000; A. Afzali, pers. comm., 2002; Esmaeili *et al*., 2011, 2013; Khataminejad *et al*., 2013; Mehraban *et al*., 2014; Mousavi-Sabet *et al*., 2014; Zareian *et al*., 2013; Ghasemi *et al*., 2015; Jouladeh Roudbar *et al*., 2015; Mohammadian-kalat *et al*., 2015; Abbasi *et al*., 2016; Jouladeh-Roudbar *et al*., 2016). Also found in Chitgar Lake, an artificial water body in northwest Tehran (Bagheri *et al*., 2016; Ramin *et al*., 2016; Abbasi *et al*., 2017; Ramin and Doustdar, 2017b).

Zoogeography. This is a widespread species showing great morphological variability over its range, sometimes recognised as distinct taxa. Zoogeographical relationships of these taxa and of the species to other *Alburnus* have still to be worked out.

Habitat. This species is found in rivers, streams, lakes, dams, lagoons, marshes, ditches and brackish environments. It is found in open waters of lakes along the shore or in slow rivers, avoiding turbid conditions and heavy vegetation. There was a mass mortality, presumed to be of this species, on the Babol Sar beach on 24 June 1963 (USNM 270909). It is found more abundantly at river estuaries along the Iranian Caspian shore than *Alburnus filippii* (Naderi Jolodar and Abdoli, 2004). Collection data included a temperature range of 13.3-31ºC, pH 6.9, conductivity 0.3-1.5 mS, river width 6-120 m, still to fast current, depth 40 cm or more, clear and colourless, muddy or cloudy water, mud, clay, sand, pebble, stone or concrete bottoms, encrusting, submergent (such as *Ceratophyllum*, *Potamogeton* and *Ranunculus*), emergent (such as *Phragmites* and *Typha*) and floating vegetation, and a grassy, bushy or forested shore.

Age and growth. Maturity is attained at 3 years and life span is up to 9 years. In more northern waters, most spawning males are 3^+ and 4^+ years while females are 5^+ and 6^+ years. Iranian populations probably have a similar structure but the age groups would be lower. Mature males averaged 9.7 cm and females 10.5 cm in one study in Russia (Berg, 1948-1949). Esmaeili *et al*. (2014) gave a *b* value for 30 fish from the Tigris River, 7.31-11.2 cm total length, as 3.29 Esmaeili *et al*. (2014) gave a *b* value for 36 fish, 8.0-12.0 cm total length, as 3.18. Mousavi-Sabet *et al*. (2014) gave a *b* value of 2.822 for 30 fish, 4.89-6.54 cm total length, from the Miriseh River. MoradiChafi *et al*. (2017) recorded the average age of fish in Chitgar Lake, Tehran as 3.5 years.

Food. Food is planktonic crustaceans, benthic crustaceans such as amphipods, flying insects which land on the water surface, aquatic insects such as backswimmers (Notonectidae), algae, diatoms, and fish eggs and fry. MoradiChafi *et al*. (2017) recorded the diet of fish in Chitgar Lake, Tehran as algae, phytoplankton, zooplankton and benthos. The fish fed on Chironomidae, Ephemeroptera, Betidae, Odonata larvae, Diptera eggs and some fish larvae, along with some filamentous algae and periphyton which included *Cyclops*, Copepoda and Cladocera. The highest number of food item was Chironomidae at 94.1%. The average condition factor was 0.86, intestine length was 0.6 and feeding intensity was 253.8. This fish was more carnivorous in the lake, and the feeding rate was good.

Reproduction. Iranian specimens had 1.1 mm diameter eggs in a sample caught on 11 June 1962 (CMNFI 1979-0265) and mature males were collected on 10 July 1962 (CMNFI 1979-0686). Specimens collected in September showed egg resorption while those taken in December had small, developing eggs and those taken in April with better developed eggs. The specimens were small and spawning probably occurred in July for these fish and possibly June for larger ones.

June was the main spawning month in Azerbaijan judging by egg diameters and condition factors (Abdurakhmanov, 1962). Older fish spawned first. Water temperature was

usually at 15-16°C or more. Spawning took place in 3-6 stages at intervals of 9-11 days. The eggs adhered to stones, branches or vegetation. Fecundity was up to 10,000 eggs and egg diameter to 1.4 mm. Incubation lasted about one week.

Parasites and predators. Molnár and Jalali (1992) recorded the monogeneans *Dactylogyrus parvus*, *D. alatus* and *D. chalcalburni* from fish identified as *Alburnus charusini* (= *A. hohenackeri*) on the Sefid River. Shamsi *et al*. (1997) reported *Clinostomum complanatum*, a parasite causing laryngo-pharyngitis in humans, from this species in the Shirud. Daghigh Roohi (2016) recorded a *Dactylogyrus* sp. from fish identified as *A. charusini* in the Anzali Wetland. Mirhashemi Nasab *et al*. (2017) found *Diplostomum spathaceum* in fish from the Anzali Wetland with prevalence (64.51%) and range (1-5 worms in a fish). Barzegar *et al*. (2018) reported the monogeneans *Gyrodactylus gobioninum* and *G. mutabilitas* from the Talar and Babol rivers and Talar and Shirud rivers respectively in Mazandaran.

Gussev *et al*. (1993b) reported the monogenean, *Dactylogyrus chalcalburni*, from this species in the Zayandeh Rud but this fish does not occur there. The parasite may have been found in *Alburnus doriae*. Raissy *et al*. (2009, 2013) reported on a parasitic outbreak of *Lernaea cyprinacea* in the Choghakhor (= Chagha Khur) Lagoon, Chahar Mahall and Bakhtiari Province in *Alburnus alburnus*, presumably translocated specimens of this species. Mehraban *et al*. (2014) found the cestode *Ligula intestinalis* plerocercoids in this fish introduced to the Chahnimeh Lakes or Reservoirs in Sistan where it was a major threat to indigenous species.

Some European populations of *Sander lucioperca* (pike-perch) feed almost exclusively on this species. Spent adults are known to eat their own eggs. It is an important prey item for other fishes generally.

Economic importance. The scales of related species contain silvery crystals of guanine which have been extracted and used to make *essence d'orient* (or pearl essence) for artificial pearls. About 5,000 fish are required for 100 g of essence. This abundant species is of indirect commercial importance as food for more valued fishes.

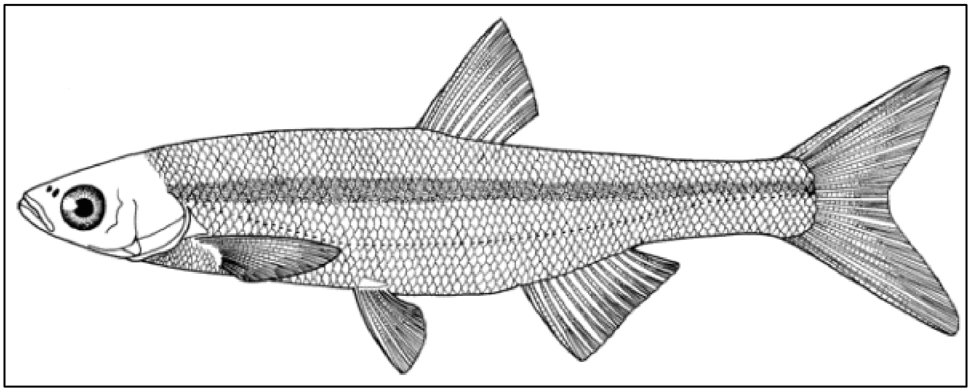
Experimental studies. Doustdar *et al*. (2018) found that the highest level of mercury contamination in a study of Aras River fish was found in this species (identified as *A. alburnus*) at 13.1 µg/g dry weight muscle tissue.

Conservation. Kiabi *et al*. (1999) considered this species to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included abundant in numbers, habitat destruction, widespread range (75% of water bodies), and present in other water bodies in Iran. Endangered in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

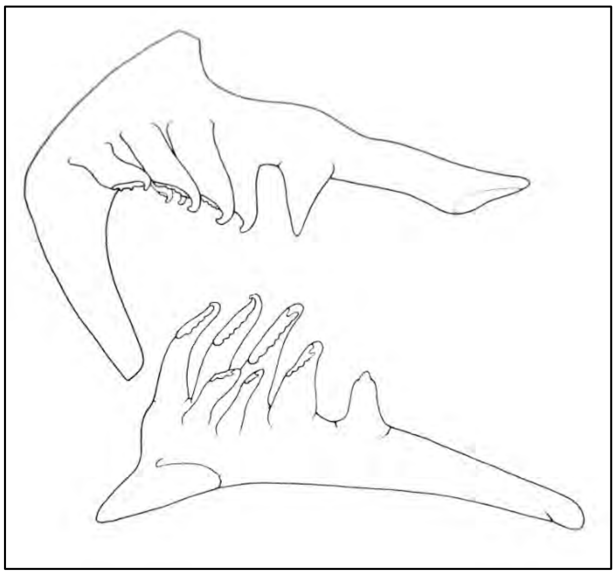
Sources. Iranian material:- CMNFI 1970-0506, 12, not kept, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0510, 8, 44.5-72.1 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0512, 3, 32.5-42.5 mm standard length, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0521, 3, 51.2-60.7 mm standard length, Gilan, Sefid River near Lulaman (no other locality data); CMNFI 1970-0522, 3, 41.1-49.5 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0526, 15, 51.9-78.7 mm standard length, Gilan, Sefid River 16 km below Astaneh Bridge (37º19'N, 49º57'30"E); CMNFI 1970-0532, 1, 64.5 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0543, 1, 37.9 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0579, 1, 49.4 mm standard length, Gilan, Old Sefid River estuary (37º23'N, 50º11'E); CMNFI 1970-0580, 27, 33.9-56.1 mm standard length, Mazandaran, river near Iz Deh (36º36'N, 52º07'E); CMNFI 1970-0581, 33, 34.4-69.1 mm

standard length, Gilan, Caspian Sea near Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0582, 1, 45.2 mm standard length, Golestan, Aliabad Reservoir (*sic*) (36º56'N, 54º50'E); CMNFI 1970-0583, 4, 47.2-61.5 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0587, 1, not kept, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0589, 21, 22.5-67.9 mm standard length, Gilan, Sefid River opposite Kisom (37º12'N, 49º54'E); CMNFI 1970-0590, 1, not kept, Mazandaran, Shesh Deh River near Babol Sar (ca. 36º43'N, ca. 52º39'E); CMNFI 1971-0343, 1, 63.5 mm standard length, Gilan, Langarud at Chamkhaleh (37º13'N, 50º16'E); CMNFI 1979-0265, 30, 61.6-90.4 mm standard length, Gilan, head of Anzali Talab at Abkenar (37º28'N, 49º20'E); CMNFI 1979-0430, 16, 38.1-59.5 mm standard length, Mazandaran, river 1 km east of Now Shahr (36º39'N, 51º31'E); CMNFI 1979-0432, 22, 34.4-54.3 mm standard length, Mazandaran, Sardab River branch (36º41'N, 51º22'E); CMNFI 1979-0434, 21, 44.9-53.6 mm standard length, Mazandaran, Shirud River (36º51'N, 50º49'E); CMNFI 1979-0435, 1, 51.9 mm standard length, Gilan, stream west of Ramsar (36º57'N, 50º37'E); CMNFI 1979-0472, 52, 25.4-63.6 mm standard length, Mazandaran, stream 7 km west of Mahmudabad (36º37'N, 52º12'E); CMNFI 1979-0475, 3, 32.4-34.7 mm standard length, Golestan, stream on road to Gorgan (36º46'N, 54º00'E); CMNFI 1979-0476, 8, 25.7-35.6 mm standard length, Golestan, Qareh Su near Kord Kuy (36º51'N, 54º05'E); CMNFI 1979-0478, 6, 19.7-29.5 mm standard length, Golestan, ditch on road to Shah Mazra'eh (37º09'N, 54º36'E); CMNFI 1979-0479, 76, 14.3-51.0 mm standard length, Golestan, dam on Gorgan River (37º09'30"N, 54º41'30"E); CMNFI 1979-0480, 6, 14.4-64.3 mm standard length, Golestan, Gorgan River at Gonbad-e Kavus (37º15'30"N, 55º09'E); CMNFI 1979-0685, 2, 57.4-60.7 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0686, 8, 50.5-70.9 mm standard length, Gilan, Sefid River above ferry (37º24'N, 49º58'E); CMNFI 1979-0695, 1 of 119, 47.8 mm standard length, Gilan, Sefid River at Manjil Bridge (36º46'N, 49º24'E); CMNFI 1979-1236, 4, 46.1-55.3 mm standard length, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0116, 23, 41.7-85.0 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0122, 41, 29.8-59.0 mm standard length, Mazandaran, Nerissi River (36º38'N, 52º16'E); CMNFI 1980-0123, 1, 53.1 mm standard length, Gilan, Sefid River around Dakha (ca. 37º22'N, ca. 49º57'E); CMNFI 1980-0128, 1, 56.5 mm standard length, Golestan, Qareh Su (36º49'30"N, 54º03'30"E); CMNFI 1980-0132, 2, 24.3-66.9 mm standard length, Gilan, Sefid River at Kisom (37º12'N, 49º54'E); CMNFI 1980-0136, 3, 33.5-50.1 mm standard length, Mazandaran, Fereydun Kenar River estuary (36º41'N, 52º29'E); CMNFI 1980-0142, 1, 53.7 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1980-0144, 2, 31.9-37.1 mm standard length, Mazandaran, Sorkh River (36º40'N, 52º25'E); CMNFI 1980-0147, 5, 44.3-61.5 mm standard length, Gilan, Lashtenesha (= Lasht Nesha') River (37º21'N, 49º52'E); CMNFI 1980-0155, 1, 38.5 mm standard length, Ardabil, Qareh Su near Ardabil (ca. 38º15'N, ca. 48º18'E); CMNFI 1980-0905, 4, not kept, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0908, 1, 70.6 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1980-0925, 27, not kept, Iran, Caspian Sea basin (no other locality data); CMNFI 1993-0134, 5, 51.0-76.7 mm standard length, Golestan, Gorgan-Aliabad (37º01'30"N, 54º47'36"E); CMNFI 2008-0113, 4, 20.1-29.3, Gilan, Caspian Sea coast near Khoshk Bijar (37º22'N, 49º47'E); CMNFI 2008-0204, 4, 58.1-71.0 mm standard length, Sistan (no other locality data); CMNFI 2008-0223, 3, 80.4-85.4 mm standard length, Iran, Aras River (no other locality data).

Alburnus sellal
Heckel, 1843



Alburnus sellal
Susan Laurie-Bourque @ Canadian Museum of Nature.



Alburnus sellal, pharyngeal teeth, Freidhelm Krupp.

Alburnus sellal, Fars, Kor River, Jörg Freyhof.

Alburnus sellal, Hamadan, Haramabad, Gamasiab River, January 2010, Keyvan Abbasi.

Common names. Shah kuli (= king fish), shah kuli-ye jonubi (= southern king fish), shah mahi (= king fish), shah kuli mosulenzis (from *A. mossulensis*); shahkuli-ye Zagros (= Zagros king fish) for *A. zagrosensis*.

[Samnan, semnan or simnan, semnan tuyel (from samnan = sleek, healthy, fat, corpulent and tawil (meaning long), hence long sleek fish) (Mikaili and Shayegh, 2011)); lassaf (meaning fluorescent), shilik (perhaps from shilig meaning a cucumber-shaped melon) and shanak and sink (perhaps variants of shilig) (Mikaili and Shayegh, 2011)); zurri at Mosul (zurri also used for *Chondrostoma regium* according to Heckel (1847a), but is also used for Oriental killifishes (Aphaniidae), *Gambusia* (Poeciliidae) and any small fishes or large fishes when young); all in Arabic; Gümüs balığı and İnci balığı in Turkish (Çiçek *et al*., 2020; Kaya *et al*., 2016); Mesopotamian bleak, Mosul bleak; Zagros bleak for *A. zagrosensis*].

Systematics. *Alburnus* (or *Chalcalburnus*) *mossulensis* Heckel, 1843 was the name under which this species was widely known in the literature of Iran but it is now regarded as a synonym as explained below. The type locality of *Alburnus mossulensis* is the “Tigris bei Mossul” according to Heckel (1843b).

Synonyms of *A. sellal* are *Leuciscus maxillaris* Valenciennes, 1844 from “rivières de Perse”, probably *Alburnus capito* Heckel, 1843 from “Gebirgsflüssen Kurdistans” (mountain streams of Kurdistan in Heckel (1843b) or "Gebirgsbache in Kurdistan" in Heckel (1847a)), *Alburnus caudimacula* Heckel, 1847 described from the “Flusse Kara-Agatsch und bei dem Dorfe Geré” (= Qarah Aqaj or upper Mond River, Fars and at the village Geré - it is not clear whether the village is a second locality or is on the Qarah Aqaj - see under *Luciobarbus barbulus*); Geré is Jereh or Jireh at 29°15'N, 51°58'E according to Edmondson and Lack (2006) and is in the Hilleh River drainage, a Dalaki River tributary (see map in Hohenacker (1845); possibly Geré is near Kereft (29°01'N, 52°52'E) as “Geré” takes a hard G in German, not a J; there may be some confusion of names and rivers here), *Alburnus Iblis* Heckel, 1847 described from the “Gegend um Persepolis oder den Gewässern des Araxes” (= probably the Pulvar (= Sivan) River near Persepolis and the Kor River, both in Fars), *Alburnus megacephalus* Heckel, 1847 described from the “Araxes”, *Alburnus Schejtan* Heckel, 1847 described from the “Araxes bei Persepolis”, and *Alburnus zagrosensis* Coad, 2009 described from a stream in the upper Karun River basin (Eagderi *et al*., 2019).

A. sellal (including its major synonym *A. mossulensis*) is apparently a widely-distributed species and unlike some other species in the Middle East has not been found to harbour localised taxa when DNA studies were carried out. The reservations noted in the **Methods** and under the genus *Alburnoides* may apply here regarding molecular data where studies involving multiloci and nuclear DNA may be apposite (and see Liu *et al*. (2017)). Since the type locality is dry, fish used in the DNA analyses were based on samples from the Gandoman Wetland or Lagoon nearby and the fish were assumed to be the same as *A. zagrosensis*. This can not now be verified.

Mousavi-Sabet *et al*. (2015) separated *A. zagrosensis* from Iranian *A. mossulensis,* now *A. sellal*, in a scatter plot of the first two principal components based on 24 morphometric characters. This may indicate further work needs to be done to clarify the limits of these putative taxa, or may simply be variation due to habitat differences documented widely for other cyprinoids herein.

Note that Eagderi *et al*. (2019) stated that Coad (2009) counted the last two dorsal and anal fin rays in *A. zagrosensis* as two when these were in fact counted as one arising from the same pterygiophore base as in all cyprinoid counts herein. This makes the counts one higher for both these fins as interpreted for my data by them in their Table 3, and thus more similar to the wide-ranging *A. sellal*.

A hybrid with *Acanthobrama marmid* with *A. mossulensis* (= *A. sellal*) was reported from the Hawr al Hammar in southern Iraq by Krupp *et al*. (1992) who also noted that *A. mossulensis* is probably a synonym of *Alburnus sellal* Heckel, 1843, a species originally described from the Quwayq River at Aleppo. However, they retained *mossulensis* as a distinct species because of colour differences and the difficulty of obtaining fresh material of *sellal* in its polluted habitat at Aleppo in Syria (see Vesiland (1993) for habitat photograph). Heckel (1847a) differentiated *mossulensis* from *sellal* by the former being slenderer and more elongate, the pelvic, dorsal and anal fins are more anterior so the caudal peduncle is more elongate, the eyes are larger and lower on the head, and there is a lead-coloured stripe separating the upper third of the body from the lower part. Berg (1949) considered that *A. mossulensis* may be nothing more than a subspecies of *A. sellal*. A principal components analysis on the types of *mossulensis* and *sellal* by me using 32 morphometric and meristic characters showed some separation between the two taxa and a Discriminant Function Analysis separated most, but not all, specimens. However, molecular evidence from Mohammdian-Kalat *et al*. (2017) placed *mossulensis* in *sellal*. Abbas Jasim (pers. comm., 17 April 2020) noted that this study used *A. sellal* from headwaters of the Quwayq in Turkey, but the Quwayq was connected to the Euphrates River not long ago, and it was possible the *sellal* material of Mohammdian-Kalat *et al*. (2017) was *mossulensis*. The synonymy of *mossulensis* with *sellal* is generally accepted, however. Birecikligil *et al*. (2016) used mitochondrial DNA to compare *Alburnus* material from Turkey including specimens identified as *sellal* and *mossulensis* and also *adanensis* (recognised as a subspecies or synonym of *sellal* from the Seyhan River near Adana, southern Turkey). Neither the *sellal* nor the *mossulensis* materials were from the type localities of these species but they were distinct and *adanensis* was recognised as synonym of *sellal* (or least material identified as *sellal*). Mangit and Yerli (2018) stated that *mossulensis* is a synonym of *sellal* in their analysis of Turkish *Alburnus* species (see online data).

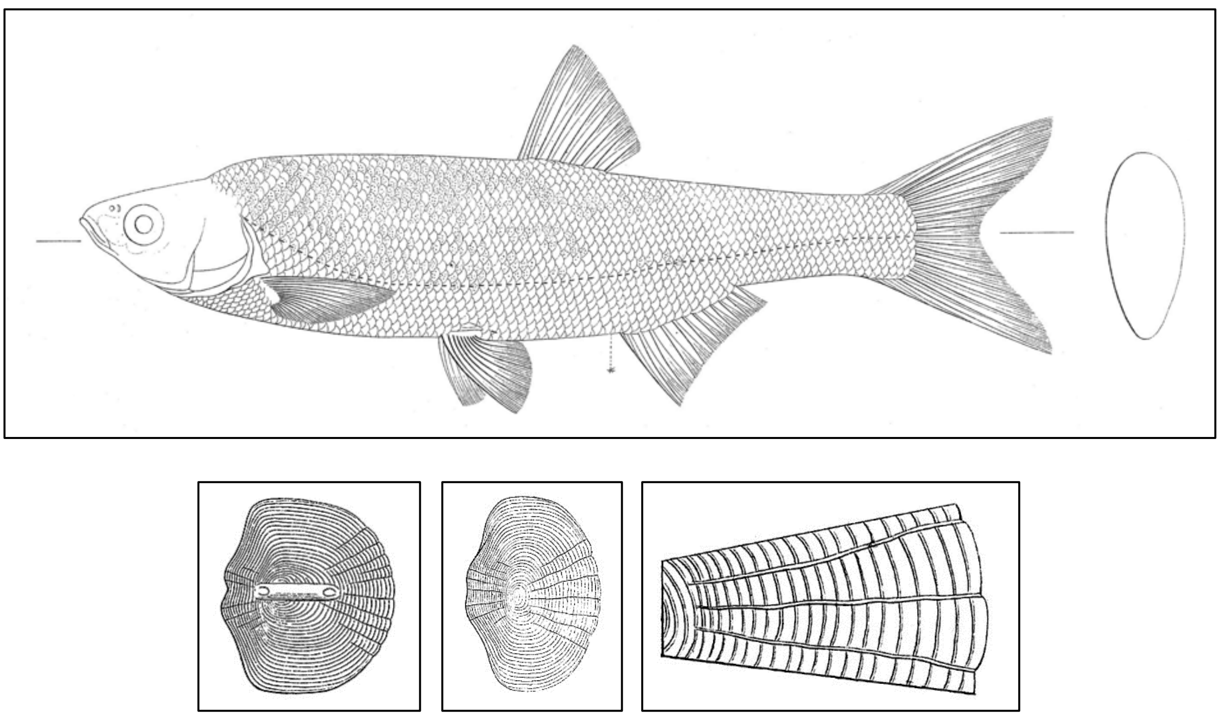
Saadati (1977) considered *Alburnus caudimacula* to be a distinct species found in the Mond River of Fars based on head length being longer (but the ranges overlap) and a shorter scaleless keel (which is individually variable in these fishes according to my observations).

A subspecies, *Alburnus mossulensis delineatus* Battalgil, 1942, of uncertain status is reported from Diyarbakir on the Tigris River in Turkey and is presumably a synonym of *A. sellal*.

As *mossulensis* is a synonym of *sellal*, the nominal taxa from outside Iran *Alburnus hebes* Heckel, 1843, *Alburnus microlepis* Heckel, 1843 and *Alburnus pallidus* Heckel, 1843, all from the Kueik (= Quwayq) River at Aleppo (Heckel, 1843b), are added to the synonymy of *sellal* as indicated by Berg (1949), Krupp (1985c) and the *Catalog of Fishes* (downloaded 1 September 2007). The three syntypes of *Alburnus hebes* seen by me in the Naturhistorisches Museum Wien

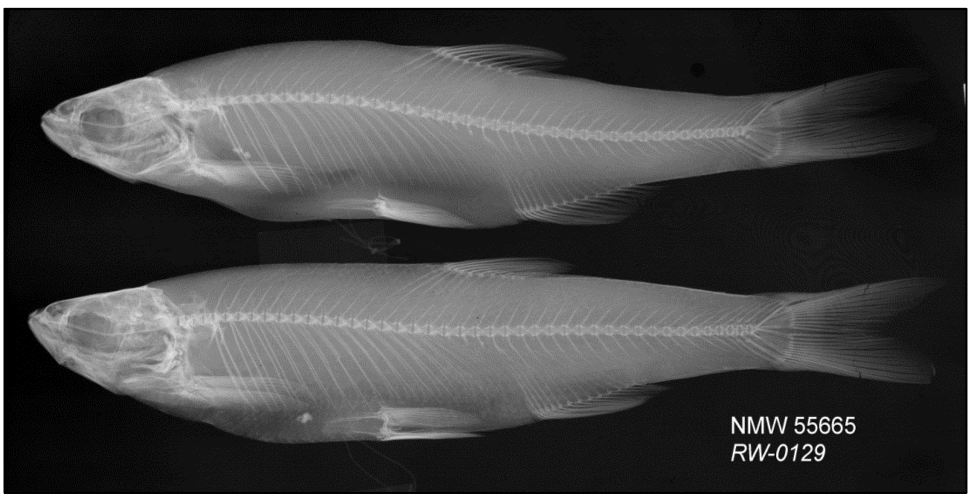
were 58.8-156.5 mm standard length (NMW 17558-17560) (but Eschmeyer *et al*. (1996) and the Ichthyology Type Database, NMW (downloaded 9 July 2016) listed NMW 55523 for these syntypes, and the card index had this number in 1997; possibly they were renumbered). One of these fish is designated as the lectotype. The holotype of *Alburnus microlepis* (NMW 55655) measures 119 mm standard length (Krupp, 1985c). The holotype of *Alburnus pallidus* (NMW 55720) measured 76.6 mm standard length. The types of these taxa are illustrated below alphabetically along with types from Iran.

Krupp (1985c) gave details on the syntypes of *Alburnus sellal* held at the Naturhistorisches Museum Wien. Six syntypes of *A. sellal*, 124-140 mm standard length, were listed as under NMW 55665 (2 fish, 137.2-141.3 mm standard length, my measurements), NMW 55666 (4, 126.9-142.7 mm standard length), and 3, 110-152 mm standard length, were under NMW 55664 (1, 110.5 mm standard length) and NMW 55667 (2, one of which is designated as the lectotype, 140.7-155.4 mm standard length). Eschmeyer *et al*. (1996) listed NMW 55664-67 as having 1, 2, 4, and 2 fish in each number in the series and also two syntypes (RMNH 2666) in the Rijksmuseum van Natuurlijke Historie, Leiden from NMW. The catalogue in Vienna listed eight specimens of *A. sellal*. B. Riedel (pers. comm., 11 April 2019) also listed NMW 94797 as a syntype (dry bone, *sic*, probably a dried or stuffed specimen in this case).



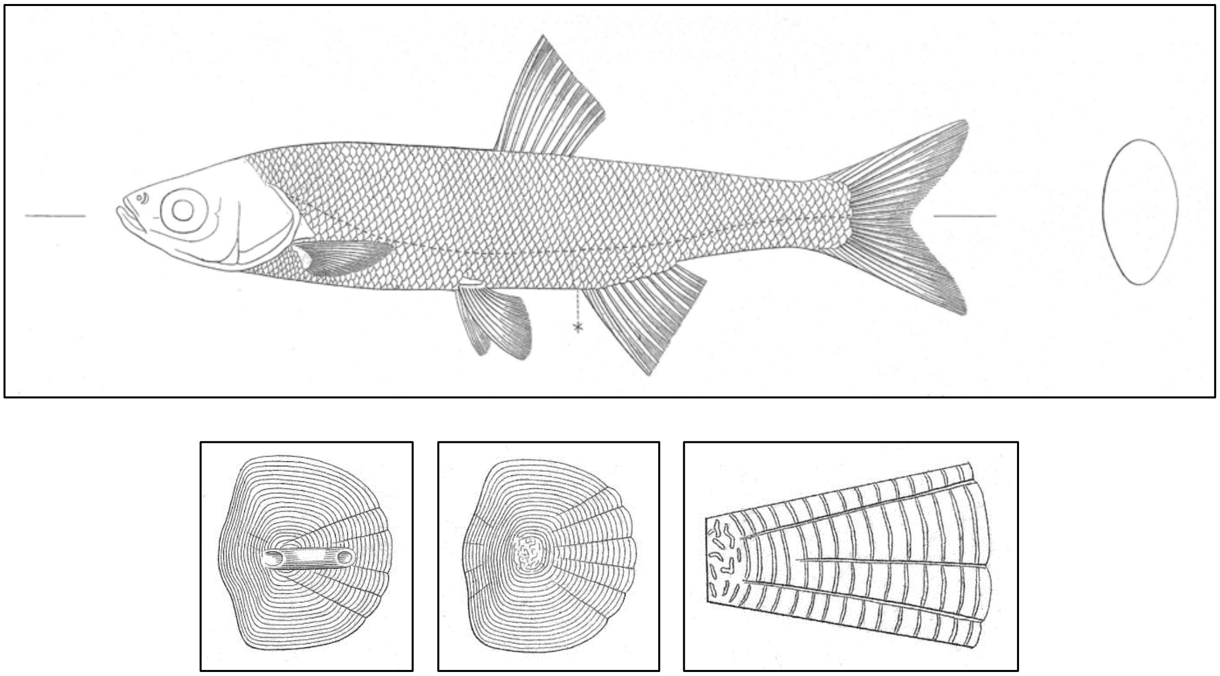
Alburnus sellal,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus sellal, syntypes, NMW 55665, Naturhistorisches Museum, Wien.



Alburnus sellal, syntypes, NMW 55665, Naturhistorisches Museum, Wien.

Five syntypes of *Alburnus capito* measure 48.7-101.9 mm standard length (NMW 55505) although the catalogue in Vienna only listed four fish at an earlier visit (corrected to five in the *Catalog of Fishes*, downloaded 9 August 2020).



Alburnus capito,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus capito, syntypes, NMW 55505, Naturhistorisches Museum, Wien.

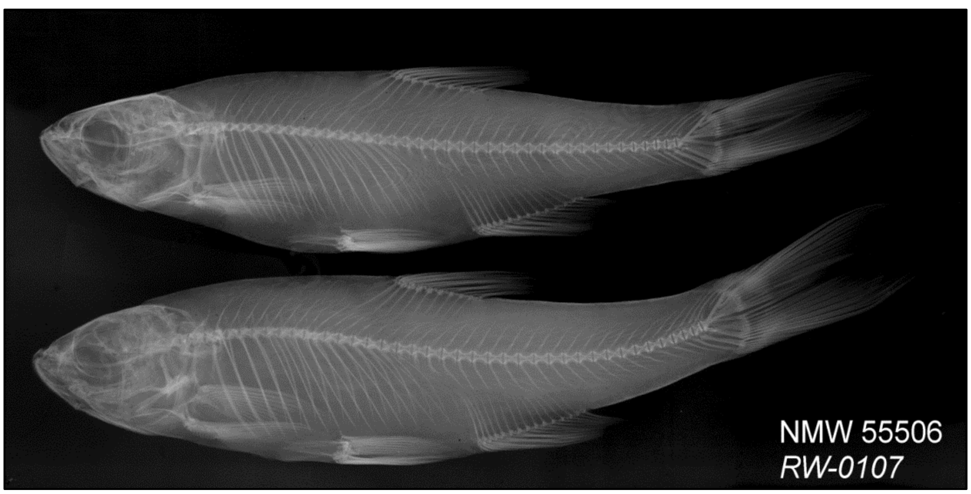
Alburnus capito, syntypes, NMW 55505, Naturhistorisches Museum, Wien.

Fifteen syntypes of *Alburnus caudimacula* are under NMW 55506 and measure 38.5-118.4 mm standard length; the catalogue in Vienna listed eight specimens in one column and what appeared to be 26 specimens in the adjacent column although this may be 20 fish with six set aside for *A. schejtan*. The Rijksmuseum van Natuurlijke Historie, Leiden has four syntypes under RMNH 2654, formerly in NMW (Eschmeyer *et al*., 1996). B. Riedel (pers. comm., 11 April 2019) also listed NMW 94792 as a syntype (dry bone, *sic*, probably a dried or stuffed specimen in this case).

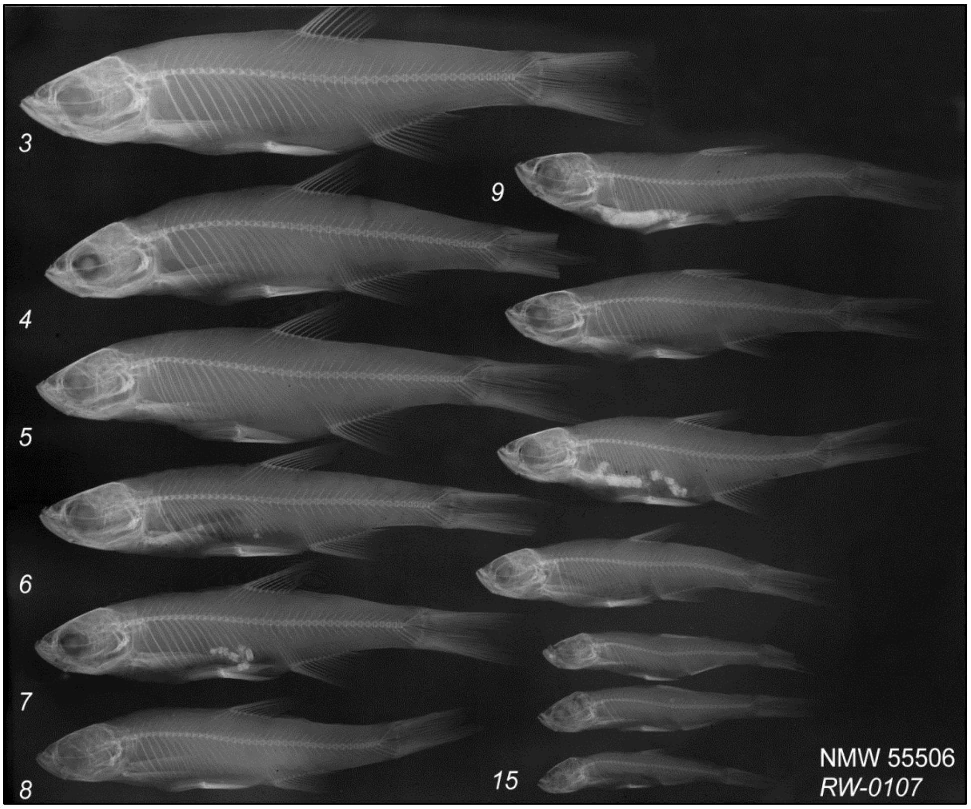
Alburnus caudimacula, syntypes, NMW 55506, Naturhistorisches Museum, Wien.

Alburnus caudimacula, syntypes, NMW 55506,
Naturhistorisches Museum, Wien.

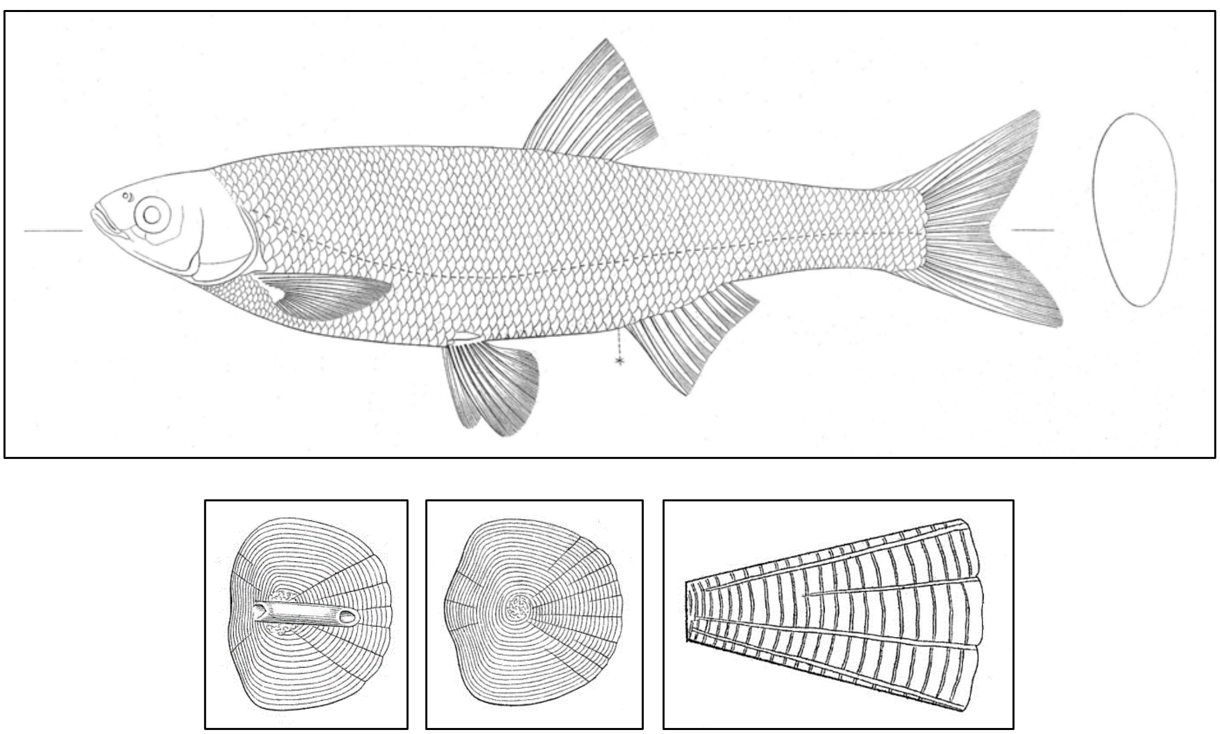
Alburnus caudimacula, syntypes, NMW 55506, Naturhistorisches Museum, Wien.



Alburnus caudimacula, syntypes, NMW 55506, Naturhistorisches Museum, Wien.



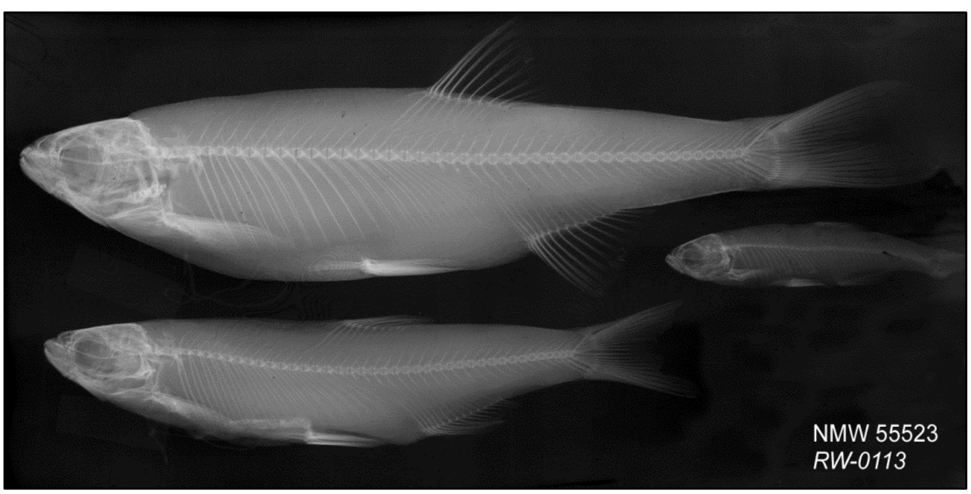
Alburnus caudimacula, syntypes, NMW 55506, Naturhistorisches Museum, Wien.



Alburnus hebes,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus hebes, syntype, NMW 55523, Naturhistorisches Museum, Wien.

Alburnus hebes, syntypes, NMW 55523, Naturhistorisches Museum, Wien.



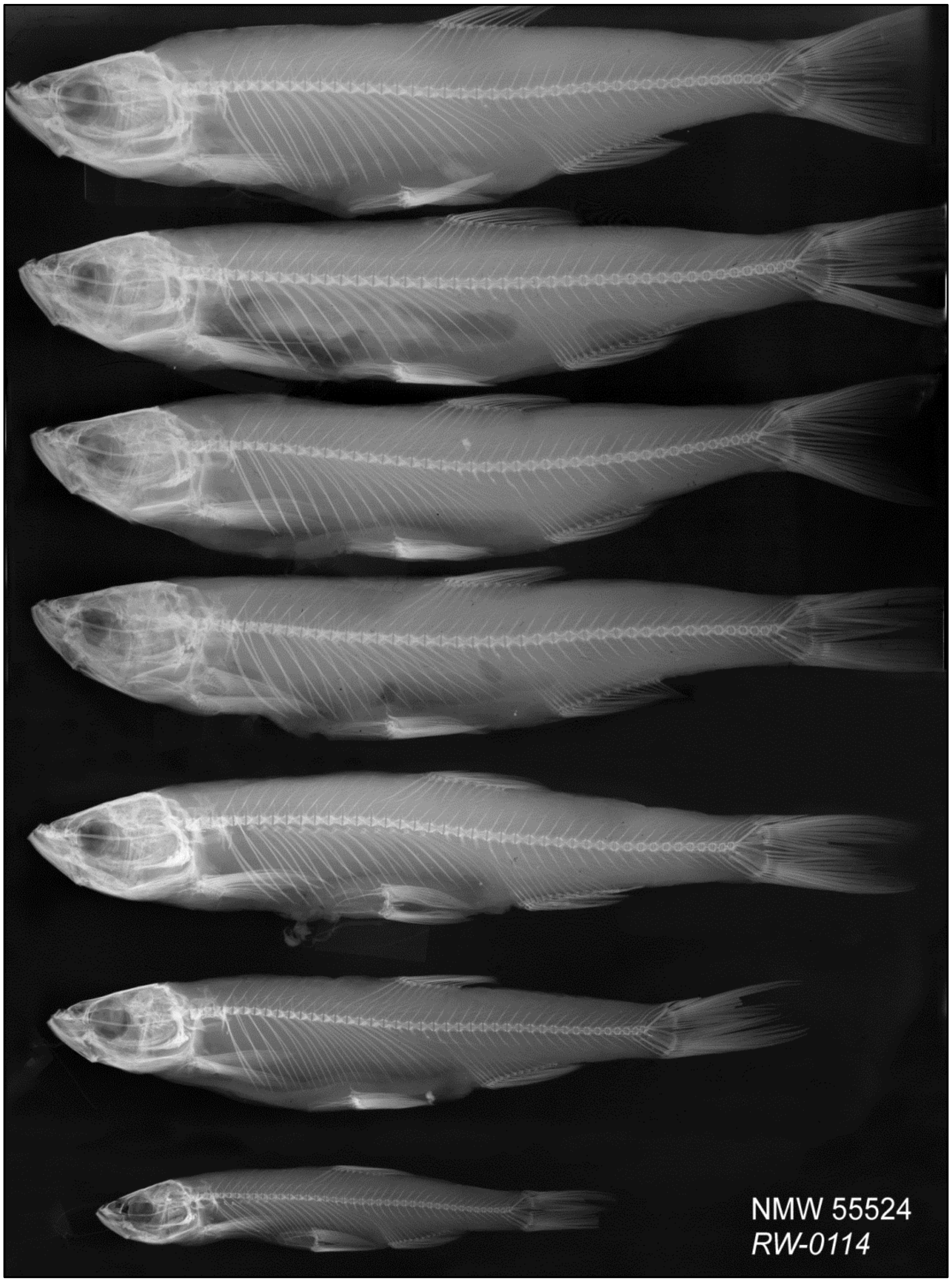
Alburnus hebes, syntypes, NMW 55523, Naturhistorisches Museum, Wien.

Seven syntypes of *Alburnus iblis* are in the Naturhistorisches Museum Wien under NMW 55524 and measure 91-165 mm standard length (Kähsbauer, 1964; 92.9-172.3 mm standard length by my measurements). One of these fish is designated as the lectotype by P. Bănărescu but does not appear to have been published (Ichthyology Type Database, NMW, downloaded 9 July 2016). The catalogue in Vienna listed eight specimens in one column and 38 in the adjacent column. B. Riedel (pers. comm., 11 April 2019) also listed NMW 94794 as a syntype (dry bone, *sic*, probably a dried or stuffed specimen in this case).

Alburnus iblis, syntypes, NMW 55524, Naturhistorisches Museum, Wien.

Alburnus iblis, syntypes, NMW 55524, Naturhistorisches Museum, Wien.

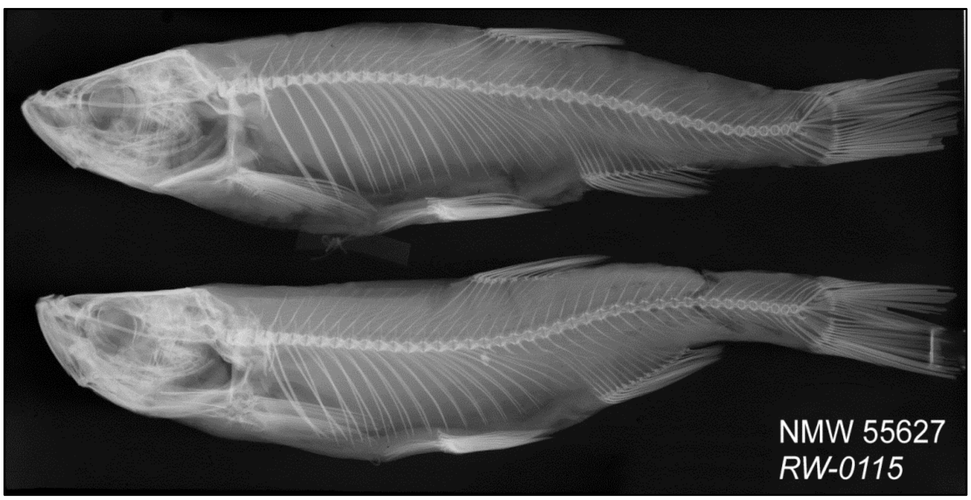
Alburnus iblis, syntypes, NMW 55524, Naturhistorisches Museum, Wien.



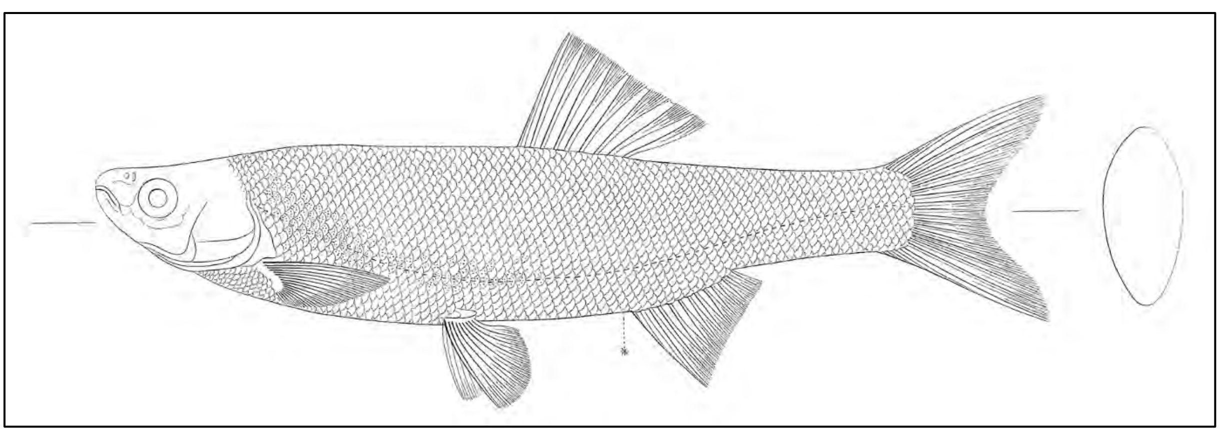
Alburnus iblis, syntypes, NMW 55524, Naturhistorisches Museum, Wien.

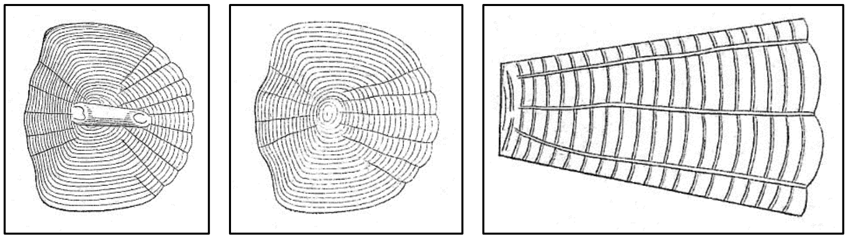
Two syntypes of *Alburnus megacephalus* are under NMW 55627 and measure 160-162 mm standard length (Kähsbauer, 1964; 162.9-166.1 mm standard length by my measurements); two specimens are listed in the Vienna catalogue. One of these fish is the lectotype.

Alburnus megacephalus, syntypes, NMW 55627, Naturhistorisches Museum, Wien.



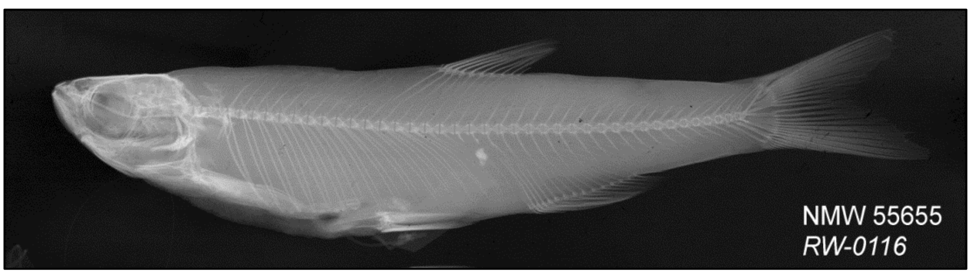
Alburnus megacephalus, syntypes, NMW 55627, Naturhistorisches Museum, Wien.





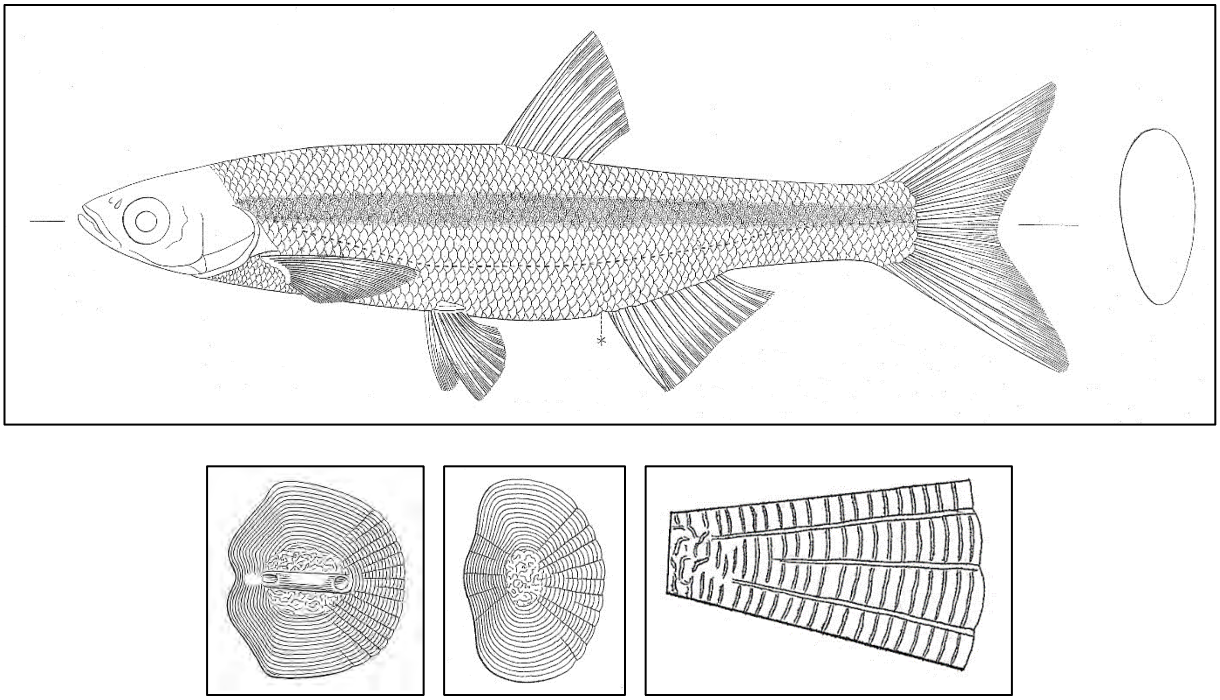
Alburnus microlepis,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus microlepis, holotype, NMW 55655, Naturhistorisches Museum, Wien.



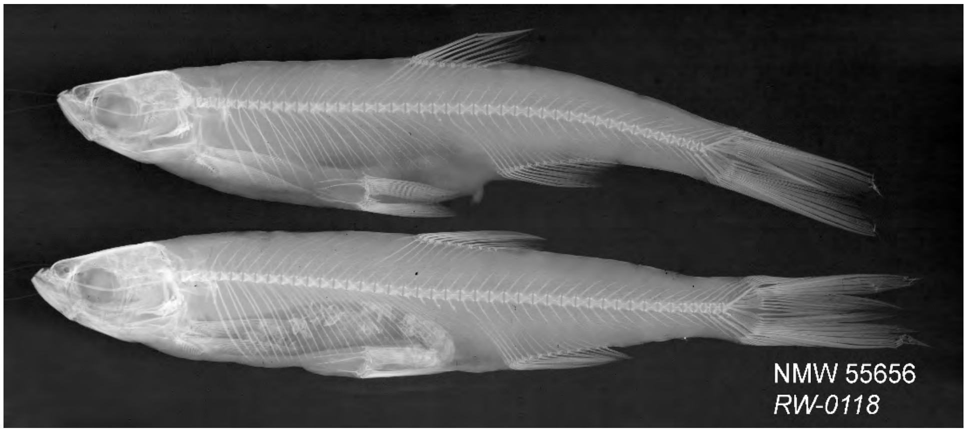
Alburnus microlepis, holotype, NMW 55655, Naturhistorisches Museum, Wien.

The syntypes of *A. mossulensis* are under NMW 55656 (2 fish, 111.2-118.4 mm standard length, my measurements), NMW 55717 (2, 83.0-89.4 mm standard length), and NMW 55718 (2, 101.9-131.5 mm standard length). Two syntypes of *Alburnus mossulensis* are in the Senckenberg Museum Frankfurt (SMF 402, formerly NMW) (F. Krupp, pers. comm., 1985; 80.1-102.7 mm standard length). Eschmeyer *et al*. (1996) also listed NMW 77723 (2, 90.4-135.4 mm standard length) and one possible syntype in the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH 2644). The catalogue in Vienna listed six specimens of *A. mossulensis*, with one specimen from NMW 77723 as the lectotype.



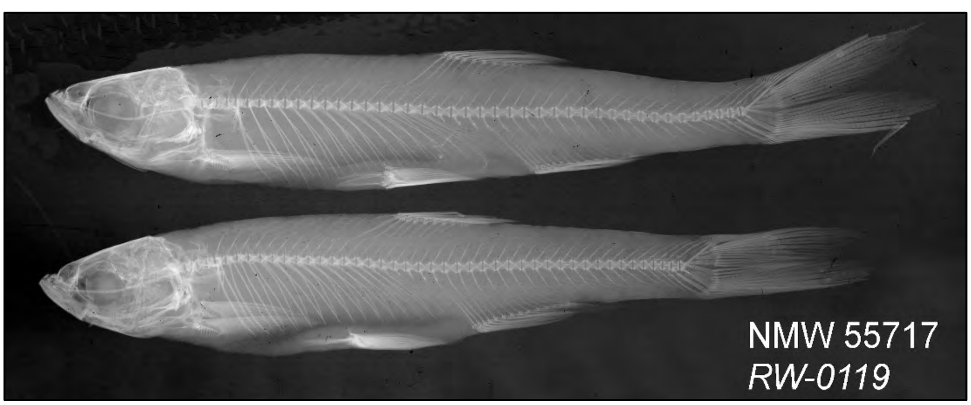
Alburnus mossulensis,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line (regenerated), and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Alburnus mossulensis, syntypes, NMW 55656, Naturhistorisches Museum, Wien.



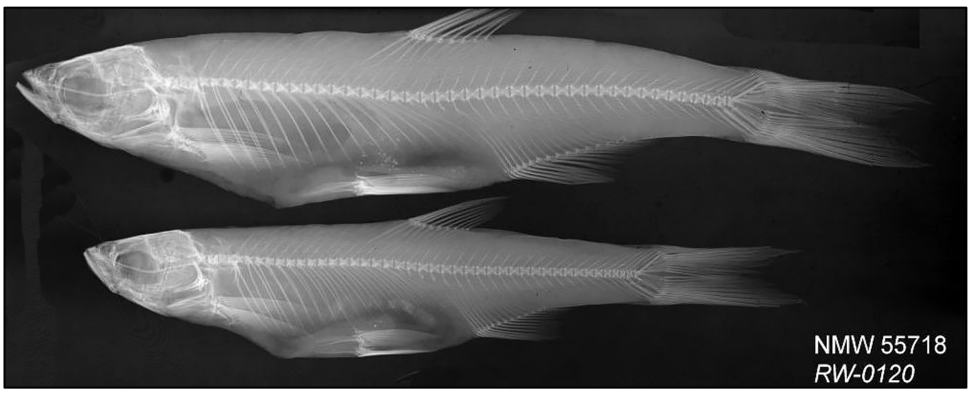
Alburnus mossulensis, syntypes, NMW 55656, Naturhistorisches Museum, Wien.

Alburnus mossulensis, syntypes, NMW 55717, Naturhistorisches Museum, Wien.



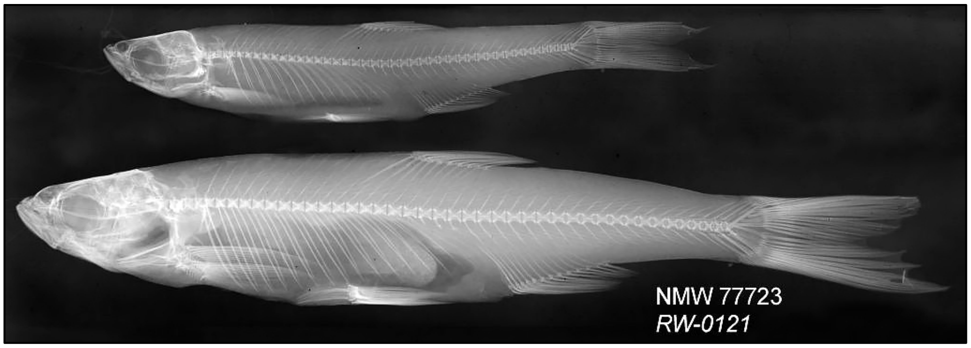
Alburnus mossulensis, syntypes, NMW 55717, Naturhistorisches Museum, Wien.

Alburnus mossulensis, syntypes, NMW 55718, Naturhistorisches Museum, Wien.

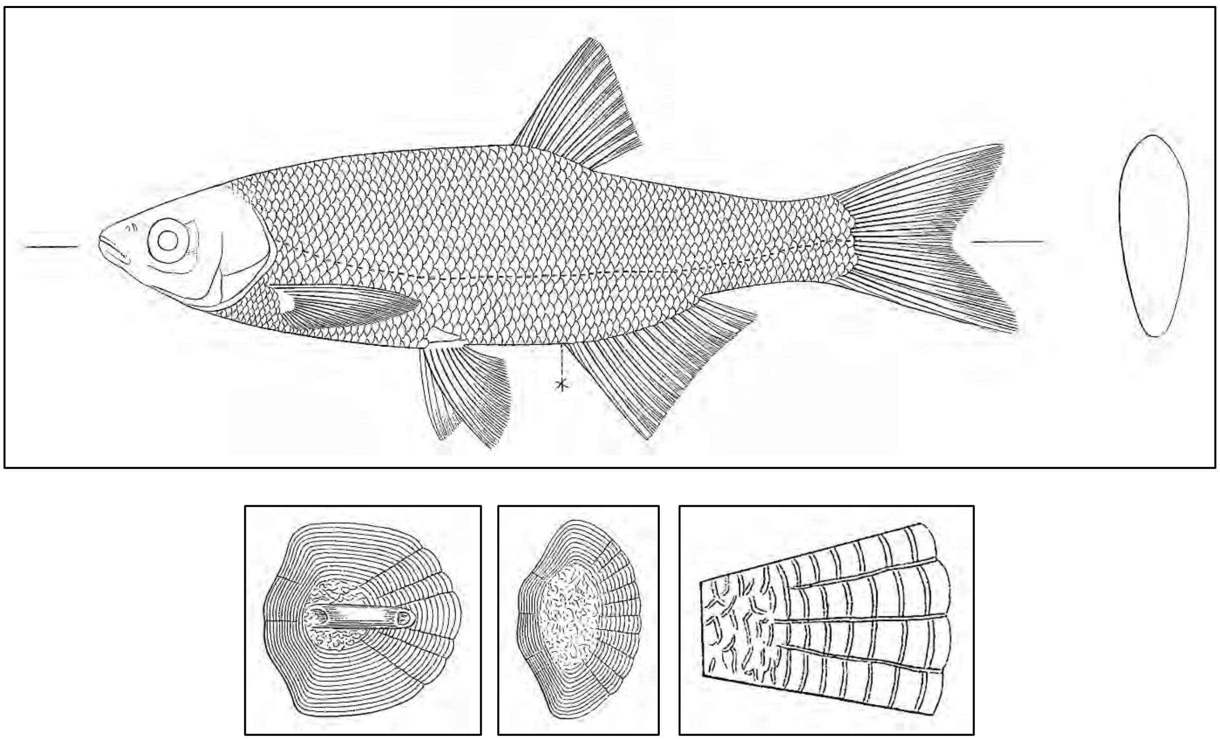


Alburnus mossulensis, syntypes, NMW 55718, Naturhistorisches Museum, Wien.

Alburnus mossulensis, syntypes, NMW 77723, Naturhistorisches Museum, Wien.

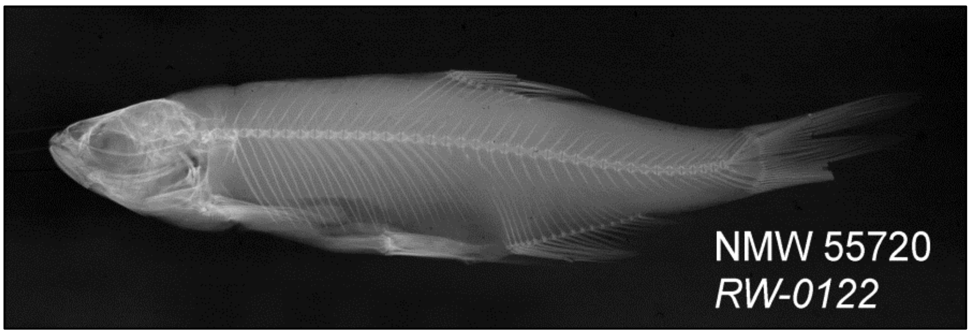


Alburnus mossulensis, syntypes, NMW 77723, Naturhistorisches Museum, Wien.



Alburnus pallidus,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line (regenerated), and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

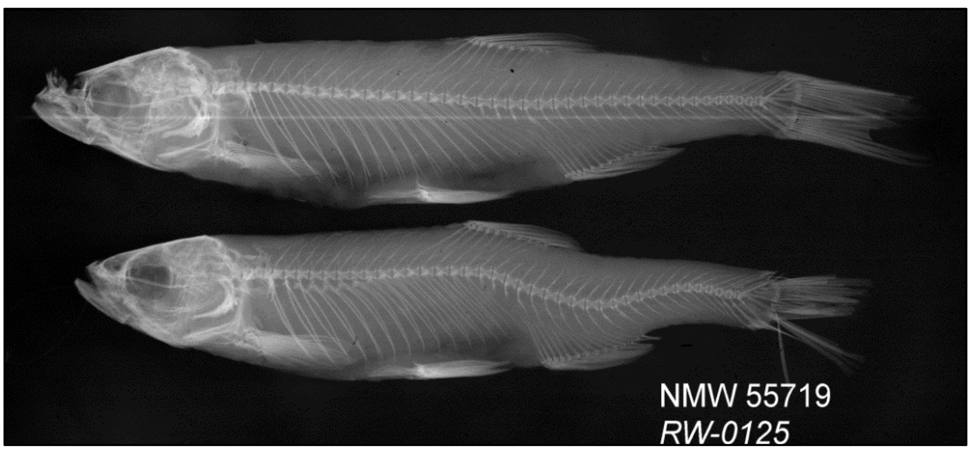
Alburnus pallidus, holotype, NMW 55720, Naturhistorisches Museum, Wien.



Alburnus pallidus, holotype, NMW 55720, Naturhistorisches Museum, Wien.

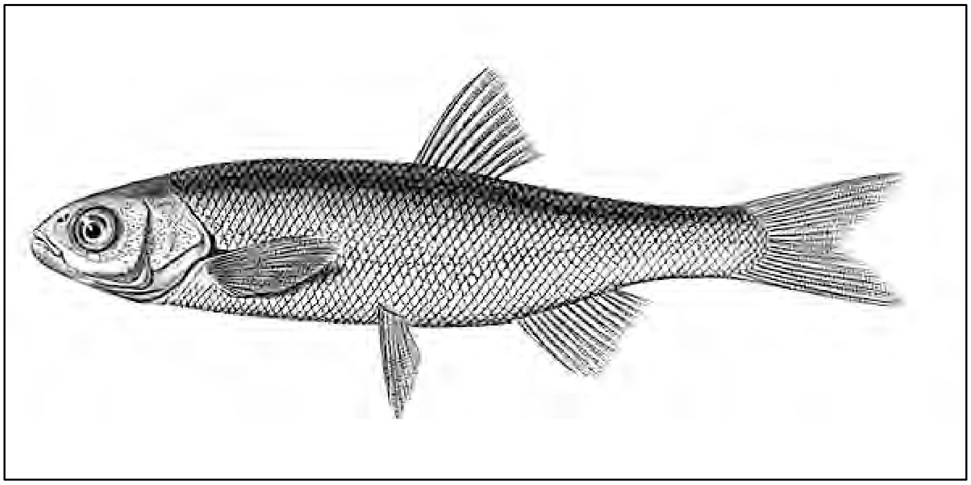
Four syntypes of *Alburnus schejtan* measure 71.7-112.6 mm standard length (NMW 22281) and one of these is designated as the lectotype, two syntypes measure 104.5-112.3 mm standard length (NMW 55663), two syntypes measure 91.8-100.0 mm standard length (NMW 55719), two syntypes measure 89-100 mm standard length (NMW 55719, after the Ichthyology Type Database, NMW, downloaded 9 July 2016), and two syntypes measure 81.6-94.4 mm standard length (NMW 55721).

Alburnus schejtan, syntypes, NMW 55719, Naturhistorisches Museum, Wien.



Alburnus schejtan, syntypes, NMW 55719, Naturhistorisches Museum, Wien.

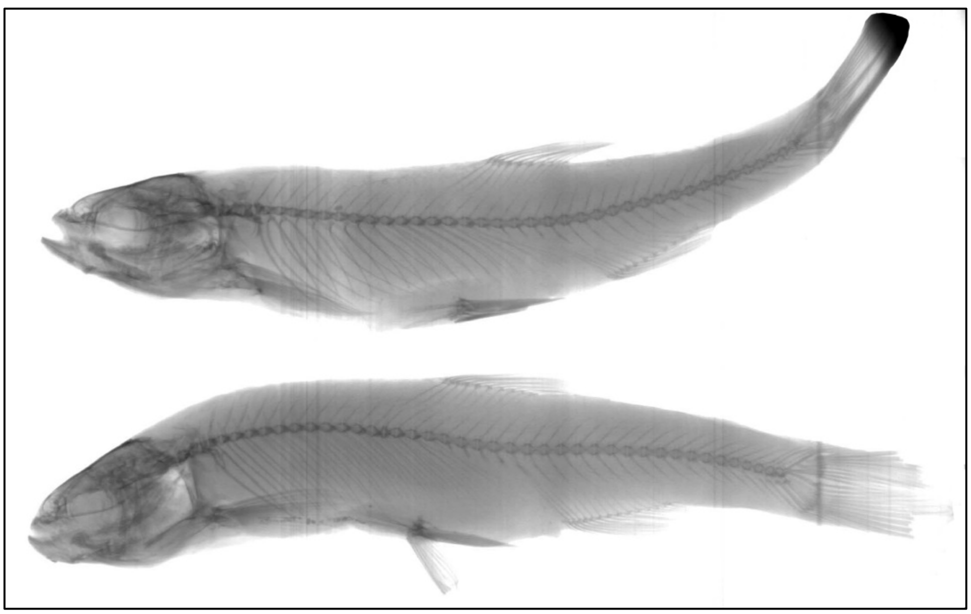
Two syntypes of *Leuciscus maxillaris*, 165-166 mm total length, are stored in the Muséum national d'Histoire naturelle, Paris (as 13954 according to Fang (1942) or as A.3954 according to Bertin and Estève (1948), M. L. Bauchot, *in litt*., 1982, and my observations). Fang (1942) regarded *maxillaris* as a distinct species in *Alburnus*. My measurements were 136.7-136.9 mm standard length.



Leuciscus maxillaris, syntype, after Valenciennes (1844).

Leuciscus maxillaris, syntypes, MNHN-IC-A-3954, S. Grosjean and M. Silvain (CC BY-NC-ND 4.0).

Leuciscus maxillaris, syntypes, MNHN-IC-A-3954, S. Grosjean and M. Silvain (CC BY-NC-ND 4.0).



Leuciscus maxillaris, syntypes, MNHN-IC-A-3954, S. Grosjean and M. Silvain (CC BY-NC-ND 4.0).

Eagderi *et al*. (2019) synonymized *A. zagrosensis* Coad, 2009 based on morphometric, meristic and molecular (COI) characters and Jouladeh-Roudbar *et al*. (2020) concurred based on their unpublished data of fish from nearby Gandoman Wetland (see above).

Alburnus zagrosensis, holotype, CMNFI 1979-0248,
James Maclaine @ Canadian Museum of Nature.

Alburnus zagrosensis, holotype, CMNFI 1979-0248,
Noel Alfonso @ Canadian Museum of Nature.

Alburnus zagrosensis, paratype, CMNFI 1979-0248A,
Bronwyn Jackson @ Canadian Museum of Nature.

Alburnus zagrosensis, paratype, CMNFI 1979-0246,
Bronwyn Jackson @ Canadian Museum of Nature.

Krupp (1985c) referred five specimens from the type series of *Alburnus doriae* to his *Alburnus sellal* and two specimens to *Leuciscus* (= *Squalius*) *lepidus*.

Bianco and Banarescu (1982) felt that their samples showed clinal variation from northwest to southeast, with numbers of anal fin branched rays, lateral line scales and gill rakers gradually decreasing. Their fish from the upper Tigris River basin in Turkey not far from Mosul (the type locality of *A. mossulensis*) and from the Pulvar River (Kor River basin of Fars) formed one subspecies while those from the Mond and Kul River basin draining to the Persian Gulf in Fars were a distinct subspecies. Available names for the former subspecies included *capito*, *iblis*, *schejtan* and *megacephalus*, the latter required a new name according to Bianco and Banarescu (1982). The Tigris-Kor sample could be *A. mossulensis mossulensis* and the Mand-Kul sample *A. mossulensis caudimacula* (see above). However, Bianco and Banarescu (1982) were correct to point out that variation in this species had not been fully examined, local environmental conditions such as temperature could affect scale counts and the problem of the relationship of *A. sellal* remained to be resolved. They found in seven specimens of *sellal* that scale counts at 71-77 (in contrast to 66-70 in Berg (1949)) overlapped with *mossulensis* counts. Berg's (1949) and my counts are very wide for fish initially identified as *A. mossulensis*, suggesting that local environment may govern meristic characters as widely demonstrated for fishes. Subspecies recognition would require much further work as Bianco and Banarescu (1982) acknowledged by not proposing a new name for the Mand-Kul fish.

Saadati (1977) referred to an unknown species of *Chalcalburnus* from Fars (CMNFI 2007-0065) here identified as *Alburnus sellal*.

Shafee *et al*. (2013) used microsatellite markers to investigate this species (referred to as *mossulensis* and as did other authors below) in the Tigris River basin of Iran finding little genetic differentiation. Yousefian *et al*. (2013) using principal components analysis found differences between populations from four rivers in the Gamasiab basin, largely in meristic characters. Dorafshan *et al*. (2014) found a high level of polymorphism although there was more interspecific (94%) than intraspecific (4%) genetic variation compared with *A. caeruleus*. Hasanpour *et al*. (2014, 2015, 2016) examined morphometric characters between populations (Gamasiab, Kashkan and Sepidbarg (= Sefid Barg) rivers versus the Khersan River versus the Karun River) in the Tigris River basin of Iran using elliptic Fourier analysis. The results showed significant shape differences between populations, e.g., the Sepidbarg population was distinguishable by having a fusiform-shaped body and other populations were distinguishable based on such a character as a shorter caudal peduncle. The differences were attributed to different environmental conditions. Jalili *et al*. (2015) distinguished this species osteologically from other members of the genus in Iran by straight dorsal and posterior opercle margins, an L-shaped and right-angled preopercle, a blunt posterior part to the vomer, by having 11 supraneurals and 43 centra, by a developed zygopophysis process, a short and thick anterior part of the palatine, and a dorsally-bent coronoid process. Keivany *et al*. (2016) examined 229 fish from eight rivers in the Tigris River basin of Iran for 18 morphometric and 12 meristic characters. A discriminant function analysis showed a low degree of separation among four populations from the Abdanan, Leileh, Little Zab and Shoisheh rivers, but high separation from other populations and among these other populations (Haran, Kangir, Rabat and Sirvan). Keivany *et al*. (2016) studied 195 specimens from ten rivers in the Karun River basin for 22 morphometric and 14 meristic characters with 21 and 13 of these significantly different between populations. The Khersan, Ivan-e Abbasi and Darband rivers were different from other populations and, although specimens from Bashar and Marbor rivers overlapped with

populations from the Banestan, Shirvan, Dopolan, Aligodarz and Sepidar rivers, these populations were different from each other. Mohammadian Kalat *et al*. (2017) sampled southern rivers in the Hormuz, Kor River, Persis and Tigris River basins and used 39 morphological characters and cytochrome *b* data for analysis. The Kor River population differed from the Hormuz and Persis populations but not from the Tigris River population. Divergence was evaluated as being at intra-specific levels. Keivany *et al*. (2018) examined 705 specimens from 27 rivers of five basins, namely Bushehr, Fars, Karkheh, Karun and tributaries of the Tigris (Diyala), for 22 morphometric and 11 meristic characters. Discriminant function analysis showed that populations from the Fars and Karun basins were different from each other and from other populations, while populations from the Diyala, Karkheh and Bushehr basins overlapped, perhaps indicating similar environmental conditions.

Abedi *et al*. (2016) found fish identified as *A. zagrosensis* from the Choghakhor (= Chagha Khur) Wetland had a wider body and larger head while fish from the Cheshmeh Ali and Hamzeh Ali areas had a lower body depth. Hedayati *et al*. (2016b) carried out a morphometric comparison of fish identified as *A. zagrosensis* from the Cheshmeh Ali, Hamze Ali and Choghakhour (= Chagha Khur) Wetland and found a partial separation of populations attributed to geographical isolation. Total length and head length were the main features that differed, with eye diameter and dorsal fin base length.

Key characters. This species is distinguished by having modally 8 branched dorsal fin rays, 8-18 total gill rakers (usually 16 or less), 58-89 (usually 60 or more) lateral line scales, and a distribution in the Tigris River basin and basins of central and southern Iran.

Morphology. The body is compressed, vertically oval, shallow and elongate and is deepest between the end of the pectoral fin and the origin of the pelvic fin. The predorsal profile varies from convex to straight. The caudal peduncle is compressed and moderately deep. The head tapers to a pointed snout. The posterior eye lies in the anterior half of the head. The mouth is oblique and extends back level with the nostril. The lower lip projects so the mouth opening is superior. Lips are of moderate thickness. The dorsal fin margin is straight to slightly rounded and the fin origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the anterior part of the anal fin. The caudal fin is deeply forked with pointed tips. The anal fin margin is rounded anteriorly and emarginate posteriorly or gently rounded overall. The anal fin does not extend back to the caudal fin base. The pelvic fin is rounded and remote from the anal fin base. The pectoral fin is rounded and does not extend back to the pelvic fin.

Dorsal fin with 3 unbranched and 6-9 branched rays and anal fin with 3 unbranched and 8-14 branched rays (Keivany *et al*. (2016) gave a range of 7-12 anal rays for their upper Tigris River fish), pectoral fin branched rays 12-18, and pelvic fin branched rays 7-10. Lateral line scales 58-89, scales around caudal peduncle 20-25, predorsal scales 32-42, scales between lateral line and dorsal fin origin 12-18, scales between lateral line and anal fin origin 5-7, and scales between lateral line and pelvic fin origin 4-7. From 0 to 5 scales at the end of the lateral line may not be pored. The ventral keel can be very short or almost not apparent or extend to the scales between the pelvic fin bases. The keel may be flanked by one to 11 scales. A pelvic axillary scale is present. Scale shape varies from a vertical oval to a more squarish shape, the latter with rounded but abrupt dorsal and ventral anterior corners. The posterior, dorsal and ventral margins are rounded and the anterior margin is wavy or indented on each side of a central rounded projection. The focus is slightly subcentral anterior. Circuli are numerous and fine. Radii are few on both the anterior and posterior fields with fewer on the anterior field. Total gill rakers number

8-18 short and usually reach past the anterior base of the adjacent raker when appressed. Pharyngeal teeth are 2,5-4,2 or 2,5-5,2, with strongly hooked tips and serrated edges to the crowns. Variants include 2,5-5,3, 2,5-4,1, 1,5-4,2, 3,5-5,3 and 2,4-4,2. Keivany *et al*. (2016) gave 2,3,5-5,3,2 and 2,4,5-5,4,2 as counts for their fish. The gut is an elongate s-shape with a small anterior loop to the left. Total vertebrae number 39-45. Populations vary sympatrically in total vertebral counts: 40-43 and 42-45; and in abdominal counts 20-22 and 22-24 (Bogutskaya *et al*., 2000) and Keivany *et al*. (2016) gave 40-45 for their fish. Two syntypes of *A. sellal*, NMW 55665, shown above have 42 and 43 total vertebrae. Three of the syntypes of *A. capito*, NMW 55505, have 43(2) or 44(1) total vertebrae. Selected syntypes (as some are faint and difficult to count) of *A. caudimacula*, NMW 55506, have 41(8) vertebrae. The two larger syntypes of *A. hebes*, NMW 55523, have 43 and 44 total vertebrae. Seven syntypes of *A. iblis*, NMW 55524, have 41(1), 42(3) or 43(3) vertebrae. Two syntypes of *A. megacephalus*, NMW 55627, have 42 and 43 vertebrae. The holotype of *A. microlepis*, NMW 55655, has 42 total vertebrae. The four syntypes of *A. mossulensis*, NMW 55718 and NMW 77723, all have 43 total vertebrae, the syntypes NMW 55656 have 43 and 44 total vertebrae, and the syntypes NMW 55717 have 42 and 44 total vertebrae. The holotype of *A. pallidus*, NMW 55720, has 41 total vertebrae. Two syntypes of *A. schejtan*, NMW 55719, both have 41 vertebrae. The holotype of *A. zagrosensis* has 42 total vertebrae. Two syntypes of *Leuciscus maxillaris*, MNHN-IC-A-3954, have 41 and 43 total vertebrae. The chromosome number of fish from the Kızılırmak River in Turkey was 2n = 48 (Gül *et al*., 2000) but this species does not occur in this area. Yüksel and Gaffaroğlu (2008b) gave a karyotype of 2n = 50 for fish from Karakaya Dam Lake, Turkey. Arai (2011) gave 2n = 48-50.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(33), 8(336) or 9(13), anal fin branched rays 9(29), 10(41), 11(200), 12(104) or 13(8), pectoral fin branched rays 13(2), 14(35), 15(134), 16(149), 17(56) or 18(6), pelvic fin branched rays 7(61), 8(307) or 9(18), lateral line scales 58(1), 59(-), 60(2), 61(1), 62(5), 63(3), 64(9), 65(8), 66(9), 67(13), 68(11), 69(10), 70(21), 71(19), 72(32), 73(26), 74(30), 75(24), 76(25), 77(33), 78(31), 79(24), 80(17), 81(13), 82(5), 83(2), 84(2), 85(2), 86(2), 87(1), 88(1) or 89(1), total gill rakers 11(7), 12(73), 13(130), 14(123), 15(46), 16(11), 17(1) or 18(1), pharyngeal teeth 2,5-4,2(9), 2,5-5,2(5), 2,5-5,3(1), 2,5-4,1(2), 2,4-4,2(1) or 1,5-4,2(2), and total vertebrae 39(1), 40(10), 41(78), 42(163), 43(113), 44(12) or 45(1).

Sexual dimorphism. A male specimen (CMNFI 1993-0129, 140.3 mm standard length 14 May 1993) had small tubercles scattered over the top and sides of the head, up to seven small tubercles lining scale edges on the upper flank and back before the dorsal fin and a single row of tubercles on each pectoral fin ray. Tubercles may even be found on the middle of the upper lip (131.3 mm standard length, 6 July 1977, CMNFI 1979-0282).

In fish identified as *A. zagrosensis* from the type series, small tubercles are present on the mature male, on the sides and top of the head, on the dentaries, as fine ones lining the scale margins, most evident on caudal peduncle scales, and on the upper pectoral fin rays. Significant differences between males and females were found in interorbital width (wider in males), caudal peduncle depth (deeper in males), and dorsal, anal, pectoral and pelvic fin lengths (longer in males).

Colour. Overall colour is silvery. The back is a bluish- or reddish-brown, bluish-black or blackish. A dark, lead-coloured stripe runs along and above the mid-flank and has a width about the same, or less than, the eye diameter. The stripe may only be evident posteriorly. Scales above the lateral line have fine melanophores at their base. Lateral line scales can have pigment spots

above and below the tube near the base of each scale, but this is not as marked as in some *Alburnoides* spp. The dorsal, anal and caudal fins are margined with black, the latter the darkest. There may be a black spot at the caudal fin base and the first pectoral fin ray may be black dorsally. All fins can be clear or coloured. The pectoral, pelvic and anal fins are yellowish at their base. All fins may be reddish, with caudal fin the darkest. The peritoneum is brown but may be thickly speckled with black-brown spots and thus appear almost black.

In the the type series of *A. zagrosensis* the body is darker dorsally and the upper flank is much darker than the lower flank with an abrupt transition in pigmentation between the two halves along the midline. A live fish showed a more gradual transition from an olive-green back, a lighter upper flank to a white belly. The lower flank may be brownish. The anterior flank has a less defined transition with some thin bars extending downward for a short distance. The mid-flank dark pigmentation forms a weak stripe, well-defined by its ventral edge above the anal fin level but the dorsal edge is less well-defined and merges with the upper flank pigmentation. The end of the caudal peduncle has a broad, fan-shaped pigmentation. A broad stripe is present predorsally and postdorsally. The predorsal stripe may be separated into two thin stripes, one on each side of the mid-line with a very thin stripe between them. After 32 years in preservative, this pigment pattern is less evident and the division between the epaxial and hypaxial muscle masses is marked by an apparent thin line of dark pigment as the most prominent feature. Fins are mostly immaculate with only slight traces of melanophores although the caudal fin can be quite dark. The peritoneum is silvery with numerous scattered melanophores grading to fish with continuous melanophores and dark brown overall.

Size. Reaches about 22.0 cm (Ergene, 1993). Fish in the Gamasiab attained 15.5 cm standard length (females) and 14.5 cm (males) (Mousavi-Sabet *et al*., 2013) or 15.7 cm (Mousavi-Sabet *et al*., 2014).

Distribution. Earlier records appeared under *A. mossulensis*. This species is found in the Tigris-Euphrates basin and adjacent basins. In Iran it is recorded from the Hormuz, Kor River, Lake Maharlu, Persis and Tigris River basins. In the Hormuz basin in the Korbal, Koshake, Kul, Rudbal (= Rudbar) and Shur rivers; in the Kor River basin in the Ghadamgah Spring-Stream system, Gomban Spring, Kaftar and Kamfirouz lakes, the Kor, Marghan, Shadkam, Shesh Pir, and Sivand (= Pulvar) rivers, and Dorudzan Dam; in the Lake Maharlu basin in springs and qanats such as Ab-e Paravan and Barm-e Dalak; in the Persis basin in the Dalaki, Dasht-e Palang, Fahlian, Helleh, Jereh, Kohmarreh Sorkhi, Maran, Mond, Qara Aqaj, Qasook, Shapur, Shiv, Shur, Tangab and Zohreh rivers, in the Chehel Cheshmeh and Dadina springs and in Parishan Lake; and in the Tigris River basin in the Abdanan, Ab-e Barik, Abloum, Abshalamzar, Agh Bolagh, A`la, Aligodarz, Alvand, Armand, Arvand, Avar, Badavar, Bahmanshir, Banestan, Bazoft, Beheshtabad, Beshar, Bibi-Sayeddan, Bonestan, Chameshk, Chardavol, Darband, Darreh Asir, Davoud Arab, Dehno (= Deh Now), Dez, Dinvar, Dinorab, Divandarreh, Doab, Do Rud, Do Polan, Eivan Abbasi, Gamasiab, Gangir, Gaveh, Geravand, Godarkhosh, Haramabad, Haran, Harud, Houzian, Ivan-e Abbasi, Jagiran, Jarrahi, Kahman, Kahnak, Kalwi, Kangavar Kohneh, Kangir, Kanjan Cham, Karkheh, Karun, Kashkan, Kelas, Kerend, Khersan, Kheyrabad, Khondab, Khorram (Khorramabad), Komasi, Kupal, Leyleh, Little Zab, Malayer, Marbor, Marun, Marvil, Meymeh, Nahr-e Shavor, Pir Salman, Qareh Su, Qeshlaq, Rabat, Ravand, Razavar (= Raz Avar), Sarab Gamasiab, Semeh, Sepidbarg (= Sefid Barg), Sepidan, Shilaghab, Simareh, Shoisheh, Shoshir, Shur, Sirvan, Sulgan, Tangab, Yuzidar, Zard and Zimakan rivers, the Gandoman and Choghakhor (= Chagha Khur) lagoons or wetlands, Gamasiab, Haramabad, Pir Salman and Shadegan wetlands, Azad, Dez, Gamasiab, Kamal Saleh and Qeshlaq dams,

sarabs at Kermanshah, and the Cheshmeh Ali, Hamzeh Ali and Mirsolayman springs (M. Hafezieh, pers. comm.; Berg, 1949; Bianco and Banarescu, 1982; Gh. Izadpanahi, pers. comm., 1995; González-Solís *et al*., 1997; Abdoli, 2000; Fadaei Fard *et al*., 2001; Barzegar and Jalali, 2002; Barzegar and Jalali Jafari, 2006; Eskandari *et al*., 2007; Abbasi *et al*., 2009; Teimori *et al*., 2010; Biokani *et al*., 2011; Parsa Khanghah *et al*., 2011; Bahrami Kamangar *et al*., 2012a; Bozorgnia *et al*., 2012; Zareian *et al*., 2012; Biukani *et al*., 2013; Hasankhani *et al*., 2013; Khataminejad *et al*., 2013; Pirani *et al*., 2013; Shafee *et al*., 2013; Yousefian *et al*., 2013; Dadashi *et al*., 2014; Golchin Manshadi *et al*., 2014; Hasanpour *et al*., 2014; Pirali-khierabadi *et al*., 2014, 2015; Reyahi-Khoram *et al*., 2014; Tabiee *et al*., 2014; Abdolhahi, 2015; Hasanpoor *et al*., 2015; Zamaniannejad *et al*., 2015; Abedi *et al*., 2016; Alizadeh Marzenaki *et al*., 2016; Hedayati *et al*., 2016b; Keivany *et al*., 2016, 2016, 2017, 2018; Sayyadzadeh *et al*., 2016; Taghiyan *et al*., 2016; Afraei Bandpei *et al*., 2017; Azizi *et al*., 2017; Keivany and Zamani-Faradonbe, 2017a, 2017b; Mirzergar and Kulivand, 2017; Mohammadian-Kalat *et al*., 2017; Pirali Khirabadi *et al*., 2017; Zamanpoore and Yaripour, 2017; Darvishi *et al*., 2018; Fazli *et al*., 2018; Maleki *et al*., 2018; Rezamand *et al*., 2018; Fatemi *et al*., 2019; Hasankhani *et al*., 2019; Khamees *et al*., 2019; Pishkahpour *et al*., 2019b; Nasri, 2021).

Records from the Dinvar and Razavar (= Raz Avar) rivers near Bisotun (Reyahi-Khoram *et al*., 2014) as *Chalcalburnus chalcoides* are presumably misidentifications for *A. sellal*.

Also recorded, questionably, from the Esfahan basin (Abdoli, 2000).

Zoogeography. Its former position in the genus *Chalcalburnus* indicates a relationship with fishes occurring in the Black-Caspian seas basin.

Habitat. This species is found in rivers, streams, lakes, dams, marshes, springs, ditches and qanats. Abbasi *et al*. (2009) in their study of wetlands in Hamadan Province found this species was dominant out of 23 species at 28%. Pirani *et al*. (2013) found it to be the second most abundant species at 29.4% after *Cyprinion macrostomus* at 31.3% in the Godarkhosh River, Ilam. Darvishi *et al*. (2018) reported fish identified as *A. mossulensis* were the most abundant species in the Khorramabad River. Zarkami *et al*. (2018) sampled fish identified as *Alburnoides mossulensis* (presumably *Alburnus sellal*) from eight sites from the source to the mouth of the Gamasiab River and recorded presence/absence and a set of river characteristics to analyse occurrence. Using an optimisation method, almost one-third of total recorded variables in the sampling sites including electric conductivity, bicarbonate, river width, river depth, water temperature, pH, sulphate and orthophosphate appeared to influence occurrence while based on the outcomes of a binary logistic regression model, electrical conductivity and bicarbonate were the most important ones. Hasankhani *et al*. (2019) found this species was the one most frequently caught in their survey of the Sirvan River. Pishkahpour *et al*. (2019b) investigated the effects of ecological conditions and physical and hydrological parameters and calculated the habitat suitability index for each station sampled. The average arithmetic model was the best method for calculating the index which could be used to manage the ecosystem and protect the habitat of this species.

Coad (2009) recorded habitat data for the synonym *A. zagrosensis* from the Zagros Mountains at 2,360-2,380 m on 9 June 1977 as water temperature 22-25°C, pH 6.2, conductivity 0.4-0.45 mS, stream width 1-4 m, water depth 1 m, water clear or muddy, bottom stones or mud, current slow to fast, aquatic vegetation mostly *Myriophyllum*, and the shore grassy. Some of this material was caught while leaping up a raceway. Other species caught were the cyprinoids *Capoeta coadi*, *Chondrostoma regium* and the aphaniid *Esmaeilius vladykovi*.

Hedayati *et al*. (2016b) reported the Cheshmeh Ali and Hamzeh Ali sites for the synonym

A. zagrosensis were mineral springs with strong current and little aquatic vegetation while the Chagha Khur Wetland had a gentle current and dense aquatic vegetation.

Al-Habbib (1981) demonstrated experimentally for specimens taken from the Aloka River, north of Mosul, Iraq that this species could survive temperatures in the range of about 1.25-36.2°C when acclimated (fish were identified incorrectly as *Chalcalburnus chalcoides*). Epler *et al*. (2001) found it to be the second most dominant species of fish (identified as *A. sheitan*) in lakes Habbaniyah, Tharthar and Razzazah in Iraq, comprising 10% of all fish collected. This was one of the most abundant species in the recovering marshes of southern Iraq in 2005-2006 (Hussain *et al*., 2006).

Habitat of *Alburnus sellal*, CMNFI 1979-0020, Fars, Mond River outside Kavar,
26 January 1976, Brian W. Coad.

Habitat of *Alburnus sellal*, CMNFI 2008-0130,
Khuzestan, Kupal Stream, 20 September 1995, Brian W. Coad.

Habitat of *Alburnus sellal*, Fars, Shur River near Jahrom, Persis basin
(Jahrom Shour River (1), CC BY-SA 4.0, Rizorius).

Age and growth. Esmaeili and Ebrahimi (2006) gave a significant length-weight relationship based on 76 Iranian fish measuring 3.15-8.14 cm standard length. the *b* value being 2.903. Hasankhani *et al*. (2013) gave a *b* value of 3.086 (in abstract, 3.111 in table) for 75 fish, 5.26-16.63 cm total length, from the Sirvan River. Mousavi-Sabet *et al*. (2013) found a *b* value of 3.172 for 325 fish, 7.0-15.5 cm standard length, in the Gamasiab River, indicating positive allometric growth, with condition factor (K) values significantly high in April, May and June. Mousavi-Sabet *et al*. (2014) gave a *b* value of 3.279 for 30 fish, 10.09-15.69 cm total length, from the Gamasiab River in a separate study. Esmaeili *et al*. (2014) gave a *b* value for 475 fish from the Persian Gulf basin, 2.03-10.9 cm total length, as 3.04 and from the Kor River basin for 68 fish, 5.78-22.4 cm total length, as 3.0 (total 3.095). Nowferesti *et al*. (2014) found a *b* value of 3.14 for 102 fish, 1.9-14.8 cm total length, from the Sefid Barg and Dinvar rivers. Hedayati *et al*. (2016a) gave a *b* value of 3.135 for 120 fish, 3.1-11.59 cm total length, from the Gamasiab Reservoir (2.9996 in the summary where the species is stated as *A. zagrosensis*). Keivany *et al*. (2016) gave a *b* value for 544 fish, 2.9-16.8 cm total length, from the Bibi-Sayyedan River of 3.0729. Radkhah (2016) found 40 fish, 19.2-74.1 mm total length, in the Hamzeh-Ali Region of Chahar Mahall and Bakhtiari Province had a mean value of *b* of 3.09 indicating positive allometric growth. Mean condition factor was 0.71. Keivany and Zamani-Faradonbe (2017a) gave a *b* value of 3.15 for 26 fish, 3.0-10.1 cm total length, from the Zohreh River. Keivany and Zamani-Faradonbe (2017b) examined 239 fish, 24.2-112.5 mm total length, from the Jarrahi River and found a *b* value of 3.42. Paighambari *et al*. (2020) gave a *b* value of 3.13 for 20 fish, 8.6-15.1 cm total length, identified as *A. mossulensis* from the Dorudzan Dam, Fars. Valikhani *et al*. (2020) combined fish, identified as *A. mossulensis*, from the Shadegan Wetland and the Dez and Karkheh rivers and reported a *b* value of 3.01 (isometric growth) and a condition factor of 7.15 (*sic*) for 62 fish, 6.3-13.8 cm total length. Zare-Shahraki *et al*. (2020) measured 1,435 fish,

1.2-16.8 cm total length, from the Karun River system and recorded a *b* value of 2.95.

Keivany *et al*. (2017) found age groups 0^+ to 5^+ years in fish from the Bibi-Sayyedan River in the Tigris River basin, the male:female sex ratio was 1:2.2, males outnumbered females in younger age classes and the reverse was true for older classes, males matured at age 1 year (4.6-9.1 cm total length) and females at age 2 (5.3-9.9 cm), the mean condition factor was not significantly different between sexes among all fish during different months, and length-weight relationships were $W = 0.0169L^{3.0355}$ for males (isometric growth), $W = 0.0061L^{3.1751}$ for females (positive allometric growth) and $W = 0.0066L^{3.139}$ for males, females and immature fish (positive allometric growth). Mousavi-Sabet *et al*. (2017) examining fish from the Gamasiab River found age groups 1^+ to 5^+ years, with age groups 2^+ (27.4%), 3^+ (35.6%) and 4^+ (24.6%) dominant. Fazli *et al*. (2019) studied 522 fish (as *A. mossulensis*) from the Komasi River and Azad Dam in Kordestan, 466 fish being from the dam, and found the fork length range was 7.0 to 16.4 cm (average 11.4 cm), total length range was 7.5-17.5 cm (average 12.75 cm) and the weight range was 4.3 to 48.1 g (average 18.2 g). Age range was 1-4 years with age 2 fish predominant at 56.2%. The length-weight relationship was $W = 0.0003FL^{2.7434}$ indicating a negative allometric growth. The male:female sex ratio was 1:0.49 for 134 adults in the dam, which differed significantly from the expected 1:1 ratio. Males predominated in winter and spring. The von Bertalanffy growth parameters were estimated as $L_\infty = 170.3$ mm, K = 0.46/year, $t_0 = -0.59$ year or $L_t = 170.3(1\text{-}e^{-0.46(t-(-0.59))})$. The instantaneous coefficient of natural mortality was estimated at 0.85/yr. The growth performance index (Φ') was 2.12. The instantaneous coefficient of natural mortality was 0.85/year. The average condition factor was 1.23 in the river and 1.28 in the dam and statistically significant differences were found in condition factors by seasons, being highest in spring. The average of relative condition factors (K_n) was 1.06. The K_n values were 0.97 and 1.07 in the Komasi River and Azad Dam, respectively. These results suggested the wellbeing of the fish was good.

Mousavi-Sabet *et al*. (2014) gave a *b* value of 3.102 for 15 fish identified as *A. zagrosensis*, 5.33-12.97 cm total length, from the Gandoman Lagoon. Hedayati *et al*. (2016b) found condition factors for their samples identified as *A. zagrosensis* were 0.93 (Cheshmeh Ali), 0.82 (Hamze Ali) and 0.74 (Choghakhour Wetland), significantly different suggesting variation in environmental conditions with the wetland suffering from pollution. Jafari *et al*. (2016) examined 145 fish identified as *A. zagrosensis*, 3.11-11.59 cm total length, from three populations and found a *b* value of 3.19 for the Cheshmeh Ali River, 3.69 for the Hamzeh Ali Spring and 2.97 for the Polmari River, indicating a positive allometric growth pattern for Hamzeh Ali and isometric growth in the two other populations. The condition factor was 0.74 (Polmari), 0.82 (Hamzeh Ali) and 0.93 (Cheshmeh Ali). Rezamand *et al*. (2018) gave *b* values for fish from the Houzian River, Lorestan identified as *A. zagrosensis* as 3.387 for 25 females, 5.8-8.1 cm total length and 3.341 for 56 males, 4.5-8.4 cm total length.

Jawad (2004) used eye lens diameter for ageing the young (up to age 3) of this species from the marshes north of Basrah, Iraq. Mohamed *et al*. (2015) examined 2,307 fish, 3.7-18.4 cm total length, from the Chybaish (= Chabaish) region of the lower Euphrates River in Iraq where it constituted 48.3% of the catch. Fish 7.0-12.0 cm dominated the catch, length-weight relationships were $W = 0.003L^{3.087}$ for immature fish, $W = 0.004L^{3.027}$ for males and $W = 0.002L^{3.193}$ for females, the mean relative condition factor was 1.05 for immature fish, 0.99 for males and 1.06 for females, maximum age was 4 years, von Bertalanffy growth equation was $Lt = 20.4(1\text{-}e\text{-}^{0.35(t + 0.277)})$, the male:female sex ratio was 1:1.7, and the mean L_{m50} was 8.0 cm for both sexes.

Ergene (1993) studied the growth of this species in the Karasu River of Turkey and found 4 age groups, and mentioned 5 age groups for another Turkish study. Mean fork length was 118.2 mm, 131.0 mm, 145.2 mm and 163.3 mm respectively. Condition factors for these age groups were 0.87, 0.85, 0.84 and 0.86. Türkmen and Akyurt (2000), also working on this species in the Karasu River, examined 375 fish with 8.5-18.5 cm fork length, and found age groups 1 to 6 with age group 3 the most abundant. The mean condition factor for males and females was 1.023 and 1.047 respectively. Age-length, age-weight (von Bertalanffy equations) and length-weight relationships were also calculated as $l_t = 20.41[1-e^{-0.2485} (t+1.47)]$, $l_t = 21.59[1-e^{-0.1978} (t+2.13)]$, $W = 80.77 (1-e^{-0.2485} (t+1.47)^{2.828}$, $W = 103.63 (1-e^{-0.1978} (t+2.13)^{3.082}$, LogW = -1.796 + 2.828 LogFL (r = 0.943) and LogW = -2.097 + 3.082 LogFL (r = 0.946) respectively. Length and age at first maturity were 1.26 years and 9.24 cm for males and 1.81 years and 9.65 cm for females in the Karasu River; age group 7 was the oldest recorded (Yıldırım *et al*., 2007). Alkan Uçkun and Gökçe (2015a) found that 626 fish, 12.3-20.4 cm total length, from the Karakaya Dam on the upper Euphrates basin of Turkey attained 4^+ years, length-weight relationship was $W = 0.206FL^{2.065}$ for females and $W = 0.119FL^{2.138}$ for males, growth in length equations were $L_t = 19.6[1-e-^{0.14(t+1.39})]$ for females and $L_t = 20.1[1-e-^{0.14(t+1.04})]$ for males.

Food. Fish from the Azad Dam, Sanandaj (numbering 73 or 75 in the abstract and text) were examined for stomach contents and the zooplankter Bosminidae dominated at 50.2% with *Bosmina longirostris* dominant by numerical percentage (Afraei Bandpei *et al*., 2017). The next major food group was Daphniidae (36.3%), followed by Sididae (11.3% in abstract, 11.2% in text), Cyclopidae (1.5%), Acartidae (0.7%), Nematoda (0.1%) and Testudinelidae (0.1%). Fish fed on a wider variety of foods in spring and the lowest feeding activity was in summer. Spring feeding increase was associated with the spawning season and energy preservation for gonad development. Diet also varied with age groups.

Younis *et al*. (2001b) found Shatt al Arab, Iraq fish feeding on phytoplankton (algae and diatoms) at 44%, followed by organic detritus at 36.7% (33% in a table), and arthropods at 3.1%, It had a dietary overlap of 89% with *Barbus* (= *Carasobarbus*) *luteus* in May, the highest in the study. In a study of the recovering Hammar Marsh, Iraq diet was 67.95% insects and 14.34% algae with diatoms, plants, crustaceans and fish at less than 10% each, in the Hawr al Hawizeh 66.2% insects and 19.2% algae, with amounts of diatoms and crustaceans being less than 10% each, and in the Al Kaba'ish (= Chabaish) Marsh 73.7% insects and 13.1% algae with diatoms, plants and crustaceans at less than 10% each (Hussain *et al*., 2006). Mohamed *et al*. (2016) found fish from the southern Euphrates River in Iraq fed on insects (41.2%), algae (28.74%), diatoms (15.94%), aquatic plants (12.36%), fish (3.74%) and snails (0.3%) according to the index of relative importance. Feeding activity ranged from 60.5% in March to 87.7% in October and feeding intensity varied from 6.08 point/fish to 8.7 point/fish in July.

Reproduction. Berg (1949) reported a female 15.5 cm long with mature eggs (ZISP 24014, 9 July 1914, Bani (probably Baneh) River basin, a tributary of the Little Zab River, at Germab, southwest of Sardasht, West Azarbayjan). Keivany *et al*. (2017) described reproduction in 543 fish from the Bibi-Sayyedan River. The male:female sex ratio was 1:2.2 with females outnumbering males in all age classes, age and total length at first maturity were 1 year and 5.3 cm for females and 2 years and 4.4 cm for males, minimum, maximum and average absolute fecundity were 2,064, 10,316 and 5,505 eggs, relative fecundity was 203 eggs/g body weight, egg diameters reached 2.0 mm in June with highest mean value in May, gonadosomatic indices and gonad analyses suggested spawning from March to June with a peak in April, and this fish was a group-synchronous spawner with the capacity for multiple spawnings within a

reproductive season. Mousavi-Sabet *et al*. (2017) examined 325 fish from the Gamasiab River and found a significantly different female:male sex ratio of 1:1.3, all males 70.0 mm standard length and over and all females 75.0 mm and over, and those fish approximately 2 years of age, were ripe, mean egg diameter reached 0.84 mm in May when spawning peaked at 18-22ºC, gonadosomatic indices showing the reproduction season beginning in March and breeding occurring from April to June, and average absolute and relative fecundities were 1,920 eggs (range 118-5,720 eggs) and 99 eggs/g body weight (range 10.8-205.3). Abbasi *et al*. (2020) collected 47 females from the Gamasiab River and found an absolute fecundity of 1,160-13,021, mean 5,571.7 eggs and a relative fecundity of 124.5-506.6, mean 263.4 eggs/g. Egg diameter was 0.2-1.7, mean 0.83 mm. Spring and summer was the spawning season.

Qarmat Ali River, Iraq fish had a fecundity of 1,926-11,779 eggs (Saud, 1997). Mohamed *et al*. (2015) found a peak gonadosomatic index in January for both sexes, spawning began in February and absolute fecundity was 1,119-5,022 eggs for Euphrates River fish in Iraq.

Yıldırım *et al*. (2007) examined this species in the Karasu River of Turkey and found a male:female sex ratio of 1:1.08, not significantly different from 1:1, a fecundity range of 3,012 to 11,427 eggs, significant correlations between fecundity and fork length, total weight, age and gonad weight, and a spawning season from June to August when water temperature attained 15ºC. Alkan Uçkun and Gökçe (2015a) found that Karakaya Dam, Turkey fish spawned from May to August.

Parasites and predators. Molnár and Jalali (1992) described a new species of monogenean, *Dactylogyrus holciki*, from this species in the Beshar River of the Persian Gulf drainage. González-Solís *et al*. (1997) reported *Rhabdochona denudata*, *Contracaecum* sp. larvae and Proleptinae larvae (Nematoda) from this species in the drainage of Lake Maharlu and *Contracaecum* sp. larvae in the drainage of the Kor River, both in Fars. Barzegar and Jalali (2002) reported parasites in this species from Kaftar Lake as *Lernaea cyprinacea* and *Diplostomum spathaceum*. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G*. sp. from the Beshar River of the Tigris basin in a *Chalcalburnus* sp., presumably this species. Jalali *et al*. (2005) also recorded *Gyrodactylus elegans* in the Beheshtabad River on fish identified as *A. filippii*, presumably *A. sellal* too. Barzegar *et al*. (2008) also recorded the digenean eye parasite *Diplostomum spathaceum* from this fish. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea cyprinacea* on this species. Khanghah (or Parsa Khanghah, 2010) found that *Ligula intestinalis*-affected fish in Vahdat (= Qeshlaq) Dam, Kordestan, lowering sex steroid hormone levels, reducing gonad maturation steps and causing degenerative changes in the gonads. Parsa *et al*. (2010) also found the cestode *Ligula intestinalis* caused degeneration in gonads. Parsa and Bahramian (2011) and Parsa Khanghah *et al*. (2011) found *Ligula intestinalis* in fish from Gheshlagh (= Qeshlaq) Lake (= Dam), Kordestan where it caused negative effects on condition index and gonadosomatic ratio and degenerative changes in the reproductive organs. Parsa *et al*. (2012) found 32% of fish from the Vahdat (= Qeshlaq) Dam had ligulosis (*Ligula intestinalis*) and noted also its presence in *Oncorhynchus mykiss* (rainbow trout) in this area, so interrupting the parasite life cycle is important for commercial reasons. Pirali-khierabadi *et al*. (2014) recorded the protozoan *Ichthyophthirius multifilis* and Pirali-Khierabadi *et al*. (2015) identified the metazoans *Dactylogyrus lenkorani* and *Gyrodactylus elegans* in fish from the Bazoft River, Chahar Mahall and Bakhtiari Province. Sayyadzadeh *et al*. (2016) found the anchor worm *Lernaea cyprinacea* in fish from the Kor River basin, presumably from the introduced species *Carassius auratus* and/or *Cyprinus carpio*). Golchin Manshadi *et al*. (2017) recorded *Allocreadium* sp.,

Dactylogyrus holciki, *Dactylogyrus* sp., *Gyrodactylus* sp., *Lamproglena* sp. and *Rhabdochona* sp. from fish identified as *Chalcalburnus sellal* from the Shapur River, Fars. Golchin Manshadi *et al*. (2018) reported *Allocreadium* sp., *Bothriocephalus* sp., *Cucullanus* sp. and *Rhabdocona* sp. from fish identified as *A. mossulensis* from the Fahlian River, Fars. Maleki *et al*. (2018) recorded metacercariae of the trematode *Clinostomum complanatum* from fish in the Qeshlaq River basin.

Economic importance. This species has been used in the preparation of fish meal in Iraq. Yousefian *et al*. (2013) noted that it is used as food locally in the Gamasiab River basin of Iran as did Keivany *et al*. (2017) in the Tigris River basin in Semirom. It has been caught on worm bait in the Dalaki River by A. Shiralipour (November 1976, CMNFI 1979-0125).

Experimental studies. Ansari and Raissy (2011) found fish, identified as *A. alburnus* and possibly *A. sellal*, from the Beheshtabad River had mean concentrations of 211.6, 183.3 and 68.5 μg/kg for copper, iron and zinc, attributable to fertilisers from agriculture, but levels were safe for human consumption. Banaee *et al*. (2014) found fenpropathrin, a pyrethroid insecticide, had the potential to disrupt biochemical parameters and to induce oxidative stress in this species from the Marun River. This chemical was highly toxic to the fish. Nematdoost Hagi and Banaee (2016) found adverse effects on liver biochemical parameters caused by the treated effluent from Pars Paper Industries in Khuzestan.

Conservation. An abundant species where studied, it appears to be under no threat in Iran. Endangered in Turkey as *A. mossulensis* and Vulnerable as *A. sellal* (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019). The type locality of the synonym *A. zagrosensis* is dried out although populations exist nearby (Eagderi *et al*., 2019).

Sources. Type material:- *Alburnus capito* (NMW 55505), *Alburnus caudimacula* (NMW 55506*)*, *Alburnus hebes* ((NMW 17558-17560 or NMW 55523), *Alburnus iblis* (NMW 55524), *Alburnus megacephalus* (NMW 55627), *Alburnus microlepis* (NMW 55655), *Alburnus mossulensis* (NMW 55656, 55717, 55718, 77723, SMF 402), *Alburnus schejtan* (NMW 22281, NMW 55663, 55719, 55721), *Alburnus sellal* (NMW 55664, 55665, 55666, 55667), *Leuciscus maxillaris* (MNHN A.3954), and *Alburnus zagrosensis* (CMNFI 1979-0248, CMNFI 1979-0248A, CMNFI 1979-0246).

Iranian material:- CMNFI 1970-0541, 10, 26.1-35.1 mm standard length, Fars, small brook near Shiraz on road to Kazerun (no other locality data); CMNFI 1977-0510A, 44, 35.7-154.6 mm standard length, Fars, qanat stream at Naqsh-e Rostam (29º59'30"N, 52º54'E); CMNFI 1979-0020, 50, 20.2-85.2 mm standard length, Fars, Mond River outside Kavar (29º11'N, 52º41'E); CMNFI 1979-0021, 42, 10.8-32.4, mm standard length, Iran, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0022, 81, 11.4-106.6 mm standard length, Iran, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0024, 1,435, 10.3-109.7 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0025, 87, 19.1-138.2 mm standard length, Fars, Kor River at Marv Dasht (29º51'N, 52º46'30"E); CMNFI 1979-0026, 13, 21.2-45.6, mm standard length, Fars, Shapur River at Shapur (29º47'N, 51º35'E); CMNFI 1979-0027, 24, 59.8-105.0 mm standard length, Fars, Chehel Cheshmeh (ca. 29º43'N, ca. 52º04'E); CMNFI 1979-0028, 55, 19.1-122.6 mm standard length, Fars, Zarqan, Kor River drainage (no other locality data); CMNFI 1979-0032, 1, 91.7 mm standard length, Fars, Bid-e Zard (no other locality data); CMNFI 1979-0036, 24, 82.3-115.1 mm standard length, Fars, Shapur River at Shapur (29º47'N, 51º35'E); CMNFI 1979-0047, 7, 41.4-78.2 mm standard length, Fars, spring source of Ab-e Paravan marshes (ca. 29º34'N, ca. 52º42'E); CMNFI 1979-0053, 1, 56.8 mm standard length, Fars, Shur River tributary (ca. 28-29º58-03'N, ca. 52º34-35'E); CMNFI 1979-0054, 17, 39.8-95.6 mm standard length, Fars, Shur River tributary (28-

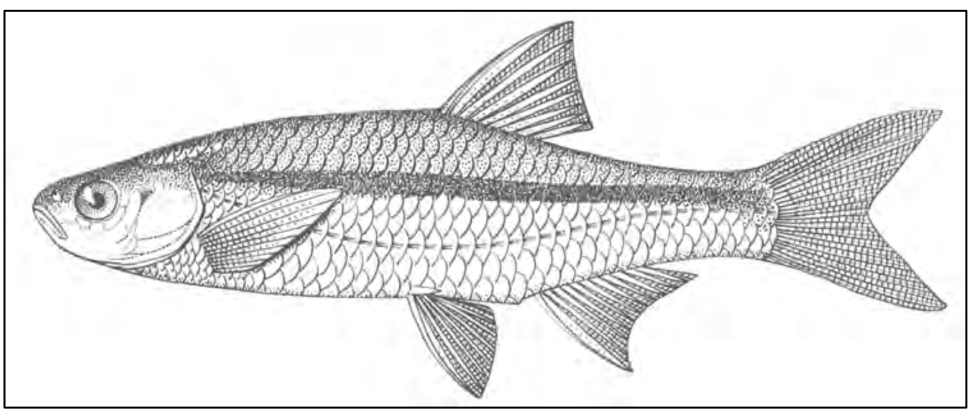
29º58-03'N, 52º34-35'E); CMNFI 1979-0057, 16, 33.0-52.5 mm standard length, Fars, stream 4 km from Shapur (29º49'N, 51º34'E); CMNFI 1979-0059, 334, 24.8-68.5 mm standard length, Fars, Pulvar River 8 km south of Sivand (30º01'30"N, 52º57'E); CMNFI 1979-0061, 51, 32.9-131.1 mm standard length, Fars, stream tributary to Pulvar River (30º04'N, 53º01'E); CMNFI 1979-0067, 55, 11.1-107.9 mm standard length, Fars, qanat at Zarqan (ca. 29º46'N, ca. 52º43'E); CMNFI 1979-0069, 2, 40.8-46.5 mm standard length, Fars, qanat at Naqsh-e Rostam (29º59'30"N, 52º54'E); CMNFI 1979-0070, 44, 35.0-98.5 mm standard length, Fars, Pulvar River near Naqsh-e Rostam (29º59'N, 52º54'E); CMNFI 1979-0071, 12, 65.3-104.3 mm standard length, Fars, qanat 23 km from Pol-e Khan (ca. 30º00'N, ca. 52º38'E); CMNFI 1979-0073, 27, 50.0-93.3 mm standard length, Fars, Mond River beyond Chehel Chashhmeh (ca. 29º42'30"N, ca. 52º01'30'E); CMNFI 1979-0074, 48, 23.8-94.0 mm standard length, Fars, Mond River backwater (29º41'N, 52º06'E); CMNFI 1979-0075, 234, 27.8-72.1 mm standard length, Fars, Mond River at Pol-e Kavar (29º11'N, 52º41'E); CMNFI 1979-0092, 1, 74.2 mm standard length, Fars, Qarah Aqaj River (ca. 29º11'N, ca. 52º41'E); CMNFI 1979-0109, 2, 69.9-73.2 mm standard length, Fars, Mond River at Shahr-e Khafr (28º56'N, 53º14'E); CMNFI 1979-0114, 136, 25.9-71.4 mm standard length, Fars, Mond River at road bridge (29º41'N, 52º06'E); CMNFI 1979-0116, 27, 25.3-57.7 mm standard length, Fars, Kor River near Marv Dasht (29º51'N, 52º46'30"E); CMNFI 1979-0117, 16, 33.4-130.0 mm standard length, Fars, Pulvar River at Naqsh-e Rostam (29º59'N, 52º54'E); CMNFI 1979-0125, 1, 102.6 mm standard length, Bushehr, Dalaki River near Dalaki (ca. 29º28'N, ca. 51º21'E); CMNFI 1979-0128, 9, 43.2-102.5 mm standard length, Fars, Shur River between Atashkadeh and Firuzabad (28º51'N, 52º31'E); CMNFI 1979-0135, 1, 42.7 mm standard length, Fars, tributary to Mond River (28º08'N, 53º10'E); CMNFI 1979-0154B, 1, 46.9 mm standard length, Fars, stream channels at Koorsiah (28º45'30"N, 54º24'E); CMNFI 1979-0155, 2, 56.2-64.7 mm standard length, Fars, spring at Gavanoo (28º47'N, 54º22'E); CMNFI 1979-0156, 11, 49.0-74.4 mm standard length, Fars, qanat in Rashidabad (28º47'N, 54º18'E); CMNFI 1979-0157, 53, 31.8-86.6 mm standard length, Fars, qanat stream at Hadiabad (28º52'N, 54º13'E); CMNFI 1979-0158, 13, 73.5-108.9 mm standard length, Fars, qanat jube over Qasook River (28º54'N, 53º53'30"E); CMNFI 1979-0159, 73, 24.5-77.5 mm standard length, Fars, qanat at Qaziabad (ca. 28º54'N, ca. 53º43'E); CMNFI 1979-0160, 22, 32.4-106.0 mm standard length, Fars, spring at Arteshkhadeh Pomp (29º09'N, 53º37'E); CMNFI 1979-0163, 12, 43.3-97.4 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0164, 12, 50.7-115.2 mm standard length, Fars, neighbourhood of Shiraz (no other locality data); CMNFI 1979-0195, 1, 71.8 mm standard length, Fars, jube on road to Fasa (ca. 28º54'N, ca. 53º53'30"E); CMNFI 1979-0200, 7, 27.6-37.4 mm standard length, Fars, Mond River tributary 13 km from Jahrom (28º36'N, 53º36'30"E); CMNFI 1979-0241, 6, 47.7-92.0 mm standard length, Fars, Shapur River at Shapur (29º47'N, 51º35'E); CMNFI 1979-0271, 51, 40.0-50.0 mm standard length, Lorestan, river in Kashkan River drainage (33º39'N, 48º32'30"E); CMNFI 1979-0272, 11, 40.5-130.0 mm standard length, Lorestan, river at Nokhor (ca. 33º40-47'N, ca. 48º28-45'E); CMNFI 1979-0273, 1, 54.7 mm standard length, Lorestan, Kashkan River drainage 5 km from Khorramabad (33º26'N, 48º19'E); CMNFI 1979-0276, 22, 43.5-65.3 mm standard length, Lorestan, Chameshk River (ca. 33º19'N, ca. 47º53'30"E); CMNFI 1979-0278, 4, 75.5-88.2 mm standard length, Lorestan, Kashkan River drainage (33º34'N, 48º01'E); CMNFI 1979-0279, 3, 68.7-91.4 mm standard length, Lorestan, Khorramabad River (33º37'N, 48º18'E); CMNFI 1979-0282, 19, 40.2-131.3 mm standard length, Lorestan, river at Nurabad (34º05'N, 47º58'E); CMNFI 1979-0283, 6, 46.1-50.4 mm standard length, Kermanshah, river in Qareh Su drainage (34º21'N, 47º07'E); CMNFI 1979-0284, 30, 73.1-98.3 mm standard

length, Kermanshah, Ab-e Barik (34º16'N, 46º48'30"E); CMNFI 1979-0285, 4, 124.7-136.8 mm standard length, Kermanshah, Qareh Su drainage (34º26'N, 46º37'E); CMNFI 1979-0287, 1, 97.5 mm standard length, Kermanshah, Cheshmeh Javari 2 km from Ravansar (ca. 34º42'N, ca. 46º40'E); CMNFI 1979-0288, 111, 24.8-73.3 mm standard length, Ilam and Poshtkuh, Gangir River at Juy Zar (33º50'N, 46º18'E); CMNFI 1979-0289, 2, 125.3-142.1 mm standard length, Kermanshah, river in Diyala River drainage (34º28'N, 45º52'E); CMNFI 1979-0290, 4, 146.9-171.4 mm standard length, Kermanshah, river in Qasr-e Shirin (34º31'N, 45º35'E); CMNFI 1979-0291, 5, 18.5-32.5 mm standard length, Kermanshah, river in Diyala River drainage (34º24'N, 45º37'E); CMNFI 1979-0305, 17, 27.5-35.6 mm standard length, Fars, Pulvar River at Pasargad (30º12'N, 53º12'E); CMNFI 1979-0342, 1, 49.9 mm standard length, Fars, Kor River at Band-e Amir (29º46'N, 52º51'E); CMNFI 1979-0348, 4, 68.0-78.8 mm standard length, Fars, stream at Somduldul (ca. 29º28'N, ca. 52º32'E); CMNFI 1979-0352, 2, 88.5-93.9 mm standard length, Khuzestan, marsh in Jarrahi River drainage (30º33'30"N, 48º48'E); CMNFI 1979-0388, 1, 32.3 mm standard length, Khuzestan, Zard River 21 km north of Ramhormoz (31º19'N, 49º44'E); CMNFI 1979-0392, 1, 44.5 mm standard length, Khuzestan, Zard River 25 km north of Ramhormoz (ca. 31º32'N, ca. 49º48'E); CMNFI 1979-0396, 2, 30.7-40.0 mm standard length, Kheyrabad River 20 km from Behbehan (30º32'N, 50º23'30"E); CMNFI 1979-0399, 1, 64.4 mm standard length, Fars, Tang-e Shib River in the Zohreh River drainage (30º19'30"N, 51º15'E); CMNFI 1979-0421, 1, 102.6 mm standard length, Kohgiluyeh and Bowyer Ahmad, stream in Khersan River drainage (30º24'N, 51º47'E); CMNFI 1979-0423, 66, 31.8-78.4 mm standard length, Kohgiluyeh and Bowyer Ahmad, river in Khersan River drainage (30º31'N, 51º31'E); CMNFI 1979-0499, 3, 104.8-133.6 mm standard length, Fars, irrigation ditch 32 km from Kor River bridge (30º04'30"N, 52º36'E); CMNFI 1979-0497, 6, 26.1-38.2 mm standard length, Fars, Mond River at Band-e Bahman (29º11'N, 52º40'E); CMNFI 1979-0500, 2, 112.2-116.5 mm standard length, Fars, Pulvar River at Naqsh-e Rostam (29º59'N, 52º54'E); CMNFI 1979-0501, 6, 27.8-34.0 mm standard length, Fars, Mond River at Kavar (29º11'N, 52º41'E); CMNFI 1980-0134, 3, 111.2-126.5 mm standard length, Iran, Shiraz-Esfahan (no other locality data); CMNFI 1991-0156, 1, 67.4 mm standard length, Hamadan, Gamasiab River (34º16'N, 48º10'E); CMNFI 1993-0129, 1, 140.3 mm standard length, Kermanshah, Sarab Najibaran (34º00-30'N, 47º00-30'E); CMNFI 1993-0130, 1, 109.9 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data); CMNFI 2007-0063, 3, 34.4-50.0 mm standard length, Fars, Mond River tributary outside Jahrom (28º36'N, 53º37'E); CMNFI 2007-0064, 9, 36.6-82.5 mm standard length, Fars, Mond River (ca. 28º50'N, ca. 53º20'E); CMNFI 2007-0065, 3, 85.1-88.5 mm standard length, Fars, Barm-e Dalak (ca. 29º35'N, ca. 52º38'E); CMNFI 2007-0075, 26, 33.4-91.5 mm standard length, Hamadan, Malayer River 5 km south of Malayer (ca. 34º17'N, ca. 48º47'E); CMNFI 2007-0099, 7, 40.7-81.2 mm standard length, West Azarbayjan, Kalwi Chay west of Mahabad (ca. 36º35'N, ca. 45º25'E); CMNFI 2007-0100, 8, 62.5-87.3 mm standard length, West Azarbayjan, Kalwi Chay near Piranshahr (ca. 36º44'N, ca. 45º10'E); CMNFI 2007-0109, 7, 36.9-78.7 mm standard length, Kordestan, Qeshlaq River south of Sanandaj (ca. 35º16'N, ca. 47º01'E); CMNFI 2007-0110, 1, 40.7 mm standard length, Kordestan, Yuzidar River drainage (ca. 35º05'N, ca. 46º56'E); CMNFI 2007-0111, 2, 116.5-170.2 mm standard length, Kermanshah, Alvand River near Sar-e Pol-e Sahab (ca. 34º36'N, ca. 45º56'E); CMNFI 2007-0112, 1, 51.2 mm standard length, Kermanshah, Kerend River basin near Shahabad-e Gharb (ca. 34º06'N, ca. 46º30'E); CMNFI 2007-0113, 1, 117.8 mm standard length, Kermanshah, Razavar (= Raz Avar) River (ca, 34º25'N, ca. 47º01'E); CMNFI 2007-0114, 13, 95.6-142.0 mm standard length, Kermanshah, Qareh Su basin north of Kermanshah (ca. 34º28'N,

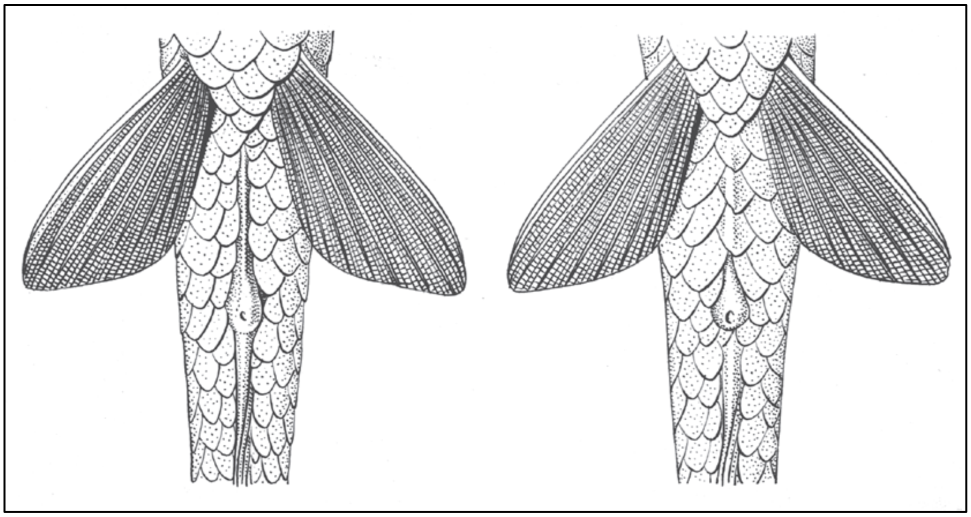
ca. 46º54'E); CMNFI 2007-0116, 3, 35.2-60.1 mm standard length, Kermanshah, Gamasiab River basin west of Sahneh (ca. 34º28'N, ca. 47º36'E); CMNFI 2007-0119, 2, 34.3-39.2 mm standard length, Kermanshah, Gamasiab River basin near Kangavar (ca. 34º31'N, ca. 48º03'E); CMNFI 2008-0102, 2, 144.0-154.2 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data); CMNFI 2008-0130, not kept, Khuzestan, stream at Kupal (31º15'N, 49º10'E); CMNFI 2008-0132, 1, 167.1 mm standard length, Khuzestan, neighbourhood of Ahvaz (no other locality data); CMNFI 2008-0161, not kept, Khuzestan, A`la River at Pol-e Tighen (31º23'30"N, 49º53'E); CMNFI 2008-0163, not kept, Khuzestan, Marun River at Chahar Asiab (30º40'28"N, 50º09'34"E); CMNFI 2008-0168, not kept, Khuzestan, Dez River at Harmaleh (31º57'08"N, 48º33'48"E); CMNFI 2008-0175, not kept, Lorestan, Kahman River at Dow Ab-e Aleshtar (33º47'N, 48º12'E); CMNFI 2008-0182, 1, 69.7 mm standard length, Chahar Mahall and Bakhtiari, Ab-e Bazoft Sofla (31º38'06"N, 50º28'30"E); CMNFI 2008-0185, 2, 57.8-70.0 mm standard length, Chahar Mahall and Bakhtiari, Sulgan River (31º30'N, 50º50'E); CMNFI 2008-0237, 1, 124.9 mm standard length, Kermanshah, Yavari Spring (34º28'N, 46º56'E); CMNFI 2008-0246, 1, 110.0 mm standard length, Fars, stream at Sepidan (29º58'19"N, 52º24'04"E); CMNFI 2008-0255, 4, 72.7-99.9 mm standard length, Fars, Kor River (30º00'N, 52º44'58"E); CMNFI 2008-0257, 3, 94.4-106.3 mm standard length, Fars, Marghan River near Sepidan (30º30'14"N, 51º53'19"E); CMNFI 2008-0261, 4, 79.7-101.3 mm standard length, Fars, Shesh Pir River near Sepidan (29º58'19"N, 52º24'04"E); CMNFI 2008-0266, 3, 52.7-85.3 mm standard length, Fars, qanat at Kherak (29º42'36"N, 52º08'54"E); CMNFI 2008-0290, 15, 54.6-150.4 mm standard length, Esfahan, Hanna Dam in Semirom (31º25'N, 51º34'E).

Comparative material:- BM(NH) 1981.4.13:9-11, 3, 64.3-72.8 mm standard length, Aloka River near Mosul (no other locality data); CMNFI 1980-0186, 3, 32.9-42.9 mm standard length, Iraq, Shatt al Arab (no other locality data); CMNFI 1980-0815, 2, 88.9-107.2 mm standard length, Turkey, Pisyar Suyu near Kozluk (38º07'N, 41º30'E).

Alburnus taeniatus
Kessler, 1874



Alburnus taeniatus, after Nikol'skii (1937).



Alburnus taeniatus, variation in keel development, after Nikol'skii (1937).

Alburnus taeniatus, Razavi Khorasan, Hari River near Pol-e Khatun, Hamid Reza Esmaeili.

Common names. Morvarid mahi navar dar (= ribboned pearl fish), morvarid mahi Harirud (Hari River pearl fish).

[Polosataya bystranka or striped bystranka in Russian; striped riffle minnow, striped tailor; all these names referring to the species when it was in the genus *Alburnoides* and so now incorrect, and perhaps striped bleak should be used].

Systematics. *Alburnus taeniatus* was described originally from the Syr Darya. No types are known. It was placed in the genus *Alburnoides* by authors (see *Catalog of Fishes*, downloaded 23 June 2018) but molecular evidence places it in its original genus (Jouladeh-Roudbar *et al*., 2016; Schönhuth *et al*., 2018).

Key characters. The absence of a strong stitched pattern along the lateral line, lower scale count on average, a higher gill raker count, and distribution in the Hari River basin serve to identify this species.

Morphology. The body is moderately deep with a deep caudal peduncle. The back in front of the dorsal fin is gently convex and is straight behind the dorsal fin. The mouth is oblique and does not reach back as far as the anterior eye margin. The tip of the lower jaw may project slightly. The dorsal fin origin lies well behind the level of the pelvic fin origin. The insertion of the dorsal fin lies over the front of the level of the anal fin and the tip of the depressed dorsal fin reaches back to about the middle of the anal fin level. The dorsal fin margin is very slightly concave. The caudal fin is moderately forked with rounded to pointed tips. The anal fin margin is

concave. The pelvic and pectoral fins have rounded margins. The pelvic fin extends back to, or slightly beyond, the anal fin origin. The pectoral fin falls short of the origin of the pelvic fin.

Dorsal fin unbranched rays 2-3, dorsal fin branched rays 7-9, commonly 8, rarely 9, anal fin unbranched rays 3-4, anal fin branched rays 9-13 in literature but 10-12, commonly 11 is more accurate, pectoral fin branched rays 10-13, and pelvic fin branched rays 6-8. Lateral line scales 30-46, usually 40-41 (from literature, the range seems rather wide and may be commonly less). There is a pelvic axillary scale. The ventral keel is scaled, partly scaled or entirely scaleless. Total gill rakers number 13-23 (this wide range suggests some counts may be lower arch only). Rakers are long and dense. Pharyngeal teeth are 1,5-5,1, 2,5-5,2, 2,4-5,2 and 1,5-5,2 (Berg, 1948-1949) with presumably the middle two counts most common. Total vertebrae number 36-39.

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(1) or 9(1), anal fin branched rays 11(2), pectoral fin branched rays 10(1), 11(-) or 12 (1), pelvic fin branched rays 7(2), and total lateral line scales 41(1) or 42(1).

Sexual dimorphism. Unknown.

Colour. The flanks and side of the head are silvery to light golden, fins mostly hyaline with some pigmentation lining rays. A wide flank stripe is present above the lateral line in preserved fish. The stitched pattern along the lateral line seen in *Alburnoides* species is absent.

Size. Attains 11.0 cm total length.

Distribution. This species is found in the Amu Darya, Syr Darya, Zeravshan and Chu rivers of Central Asia, (Berg, 1948-1949; Aliyev *et al*., 1988). Reported also from the Karakum Canal, Kopetdag Reservoir and Uzboi lakes (Shakirova and Sukhanova, 1994; Sal'nikov, 1995) in Turkmenistan on the northern border of Afghanistan and Iran and so was predicted to enter the Morghab and Tedzhen (= Hari) rivers by Coad (2014) and confirmed from the latter in Iran near Pol-e Khaton (= Pol-e Khatun) by Jouladeh-Roudbar *et al*. (2016) and in the Hari River just below the Dusti (= Doosti) Dam (Jouladeh-Roudbar *et al*., 2020).

Zoogeography. The relationships of this species lie to the west where the genus is most speciose.

Habitat. This species prefers slow-moving or still waters.

Age and growth. It attained 7.6 cm by 3^+ years of age in ponds near Frunze, Kyrgyzstan (Berg, 1948-1949). Life span is 9^+ years.

Food. Food includes gnatworms and other aquatic insects and crustaceans.

Reproduction. Females at Frunze had ripe eggs at age 2^+ and spawning there and near Tashkent occurred in June-July. Fecundity reached 9,135 eggs up to 1.0 mm in diameter. Pavlovskaya and Zholdasova (1991) recorded the descent of prolarvae and larvae in the middle Amu Darya from 12 May through 22 May.

Parasites and predators. None reported from Iran.

Economic importance. This species has appeared in the aquarium trade.

Experimental studies. None.

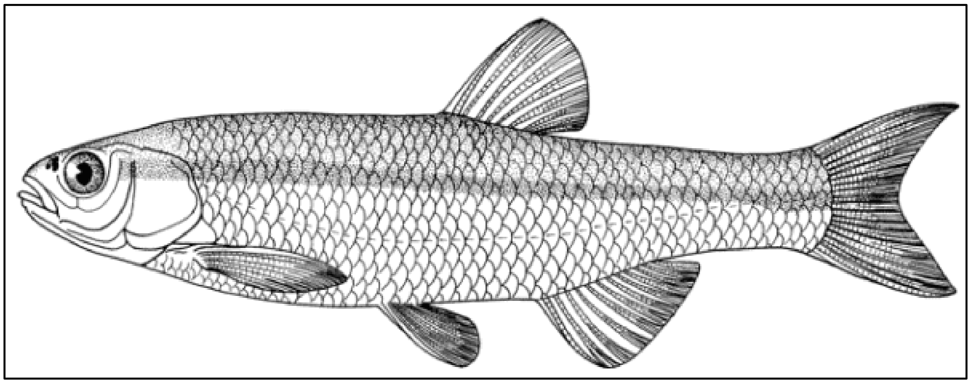
Conservation. Jouladeh-Roudbar *et al*. (2020) listed it as Data Deficient.

Sources. Jouladeh-Roudbar *et al*. (2016).

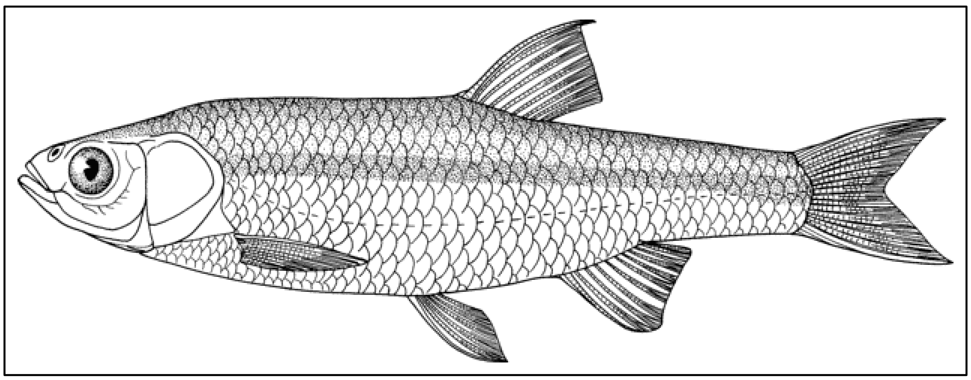
Iranian material:- None.

Comparative material:- SNM-PM 6806, 1, 59.5 mm standard length, Afghanistan, Khanabad River (no other locality data).

Alburnus ulanus
(Günther, 1899)



Alburnus ulanus
Susan Laurie-Bourque @ Canadian Museum of Nature.



Alburnus gaderanus
Susan Laurie-Bourque @ Canadian Museum of Nature.

Alburnus ulanus, West Azarbayjan, Mahabad River, Lake Urmia,
October 2011, Keyvan Abbasi.

Common names. Arus mahi-ye Orumiyeh (= bride Urmia fish, Y. Keivany, pers. comm., 25 September 2018).

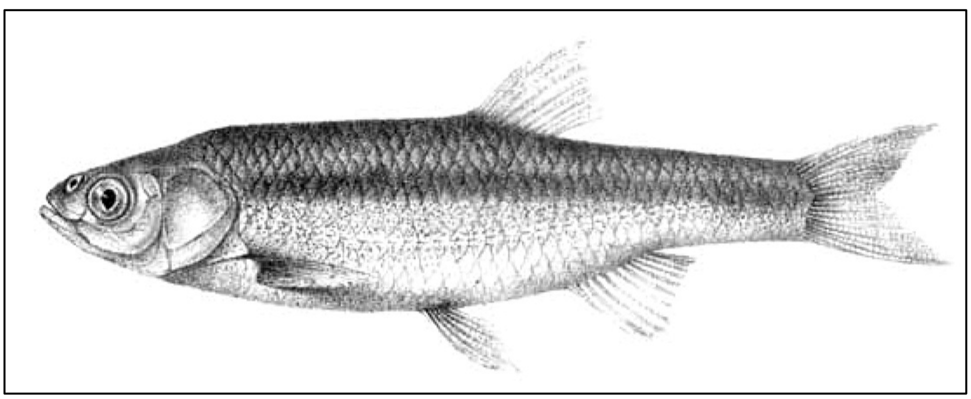
[Urmia or Urmian chub].

Systematics. This species was originally described in the genus *Leuciscus*. Saadati

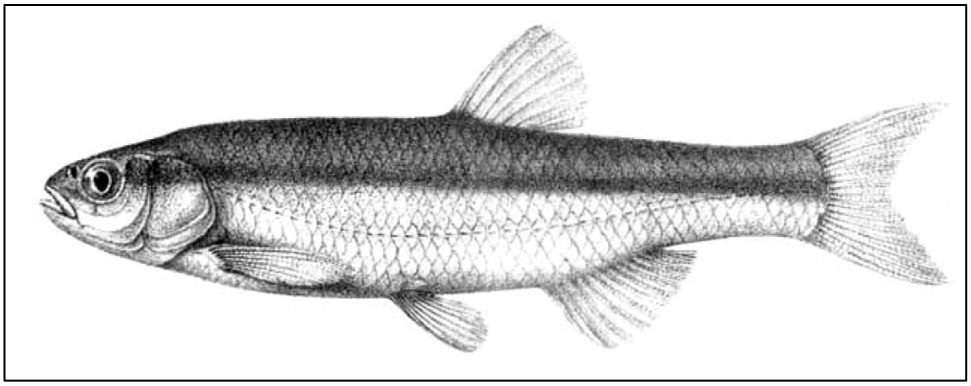
(1977) considered this species to be in the genus *Alburnus* but did not examine the types. *Leuciscus gaderanus* Günther, 1899 is a synonym, even Günther (1899), the describer of the two species, indicated that this may be the case. *Alburnus atropatenae* Berg, 1925 is also a synonym according to Jouladeh-Roudbar *et al*. (2020) based on unpublished molecular and morphological data but it is retained here until data are published (and lateral line scale counts are non-overlapping and would be 36-63 for the synonymised taxa, an unusually wide range).

Perea *et al*. (2010) and Schönhuth *et al*. (2018) using mitochondrial and nuclear DNA concluded that *Petroleuciscus* Bogutskaya, 2002 was not monophyletic and the species listed should be re-examined for generic placement. *P*. *ulanus* is now in *Alburnus* after Jouladeh-Roudbar *et al*. (2020).

The two syntypes of *Leuciscus ulanus*, 68.0-84.5 mm standard length, are in the Natural History Museum, London and are “from Ula on the Zola Chai” (= Zowla River; BM(NH) 1984.10.10:1-2). The three syntypes of *Leuciscus gaderanus*, 44.6-73.0 mm standard length, are “from the Gader Chai” (= Qader River) which is near Ocksa (BM(NH) 1899.9.30:113-115). Additionally, there are five specimens of *Leuciscus gaderanus*, 11.0-54.5 mm standard length “from near the mouth of the Nazlu Chai at Superghan” (= Sopurghan at 37°45'N, 45°12'E) (BM(NH) 1899.9.30:108-112). Günther (1899) referred to three young specimens from the latter locality as syntypes but of these five fish under this catalogue number and locality given as “Superghan” on the label only two fish are small (11.0-12.5 mm SL) and the other three fish are larger (45.8-54.5 mm SL). Another collection comprising one specimen, 27.0 mm standard length, is from the Urmi River according to the label (BM(NH) 1899.9.30:107). Its type status is unclear since the locality is wrong but the size is small and it could be the third of Günther’s “three young specimens” since its catalogue number is in sequence.



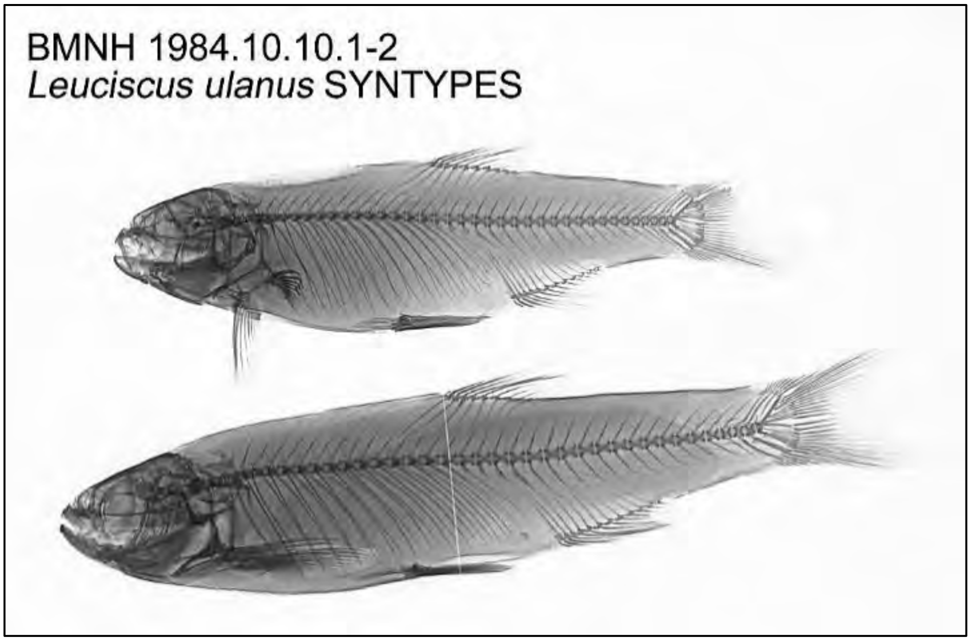
Leuciscus gaderanus, syntype, after Günther (1899).



Leuciscus ulanus, syntype, after Günther (1899).

Leuciscus gaderanus, syntype, BM(NH) 1899.9.30:108-112.

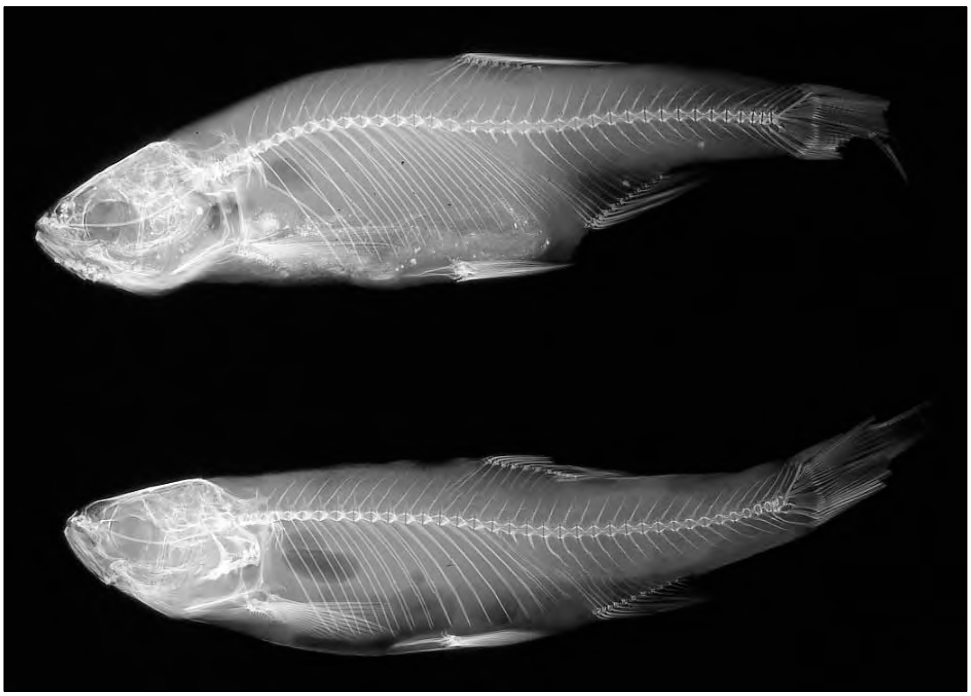
Leuciscus ulanus, syntype, BM(NH) 1984.10.10:1-2.



Leuciscus ulanus, syntypes, BM(NH) 1984.10.10:1-2.

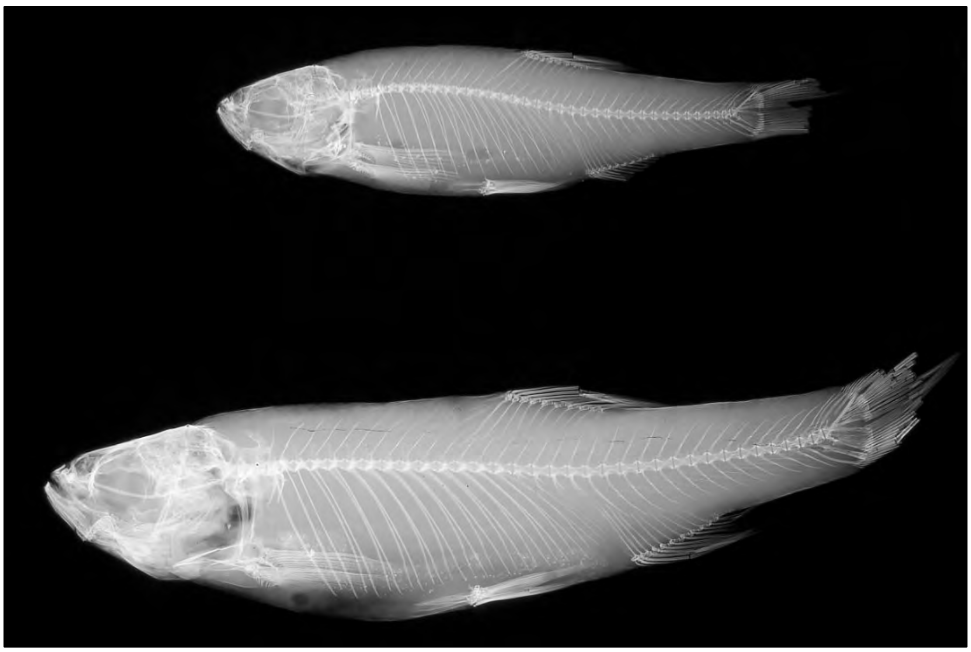
Leuciscus gaderanus,
BM(NH) 1899.9.30:108-112, Brian W. Coad.

Leuciscus gaderanus, syntypes,
BM(NH) 1899.9.30:113-115, Brian W. Coad.

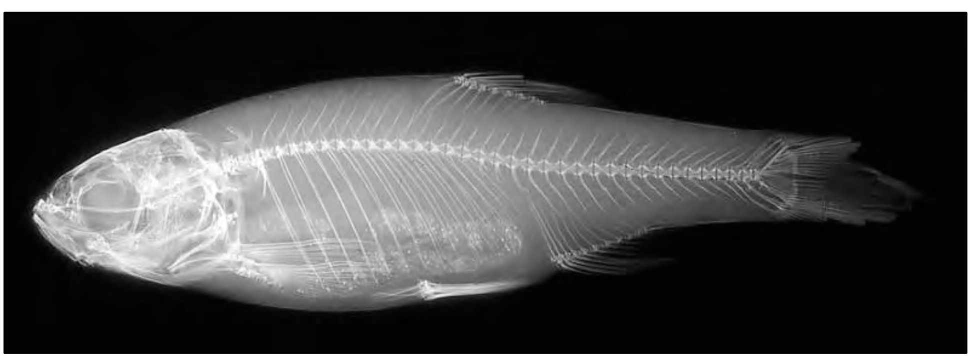


Leuciscus gaderanus, syntypes, BM(NH) 1899.9.30:108-112, Brian W. Coad.

Leuciscus gaderanus, syntype, BM(NH) 1899.9.30:108-112, Brian W. Coad.



Leuciscus gaderanus, syntypes, BM(NH) 1899.9.30:113-115, Brian W. Coad.



Leuciscus gaderanus, syntype, BM(NH) 1899.9.30:113-115, Brian W. Coad.

Key characters. This species is distinguished by having 8 branched dorsal fin rays, 12-16 total gill rakers, 36-45 lateral line scales, a silvery-brown peritoneum, and a distribution in the Lake Urmia basin.

Morphology. The body is compressed and fairly deep, being deepest between the end of

the pectoral fin and the origin of the pelvic fin. A slight nuchal hump may develop. The predorsal profile is very to slightly convex. The caudal peduncle is compressed and moderately deep. The head tapers to a rounded snout. The posterior eye margin lies at the beginning of, or anterior to, the mid-point of the head. The mouth is oblique and extends back to the nostril level or just behind the front margin of the eye and the lower jaw protrudes slightly or hardly at all (Günther (1899) has the upper jaw slightly overlapping the lower). Lips are of moderate thickness and the upper lip is thickest at the centre. The dorsal fin has a straight to slightly rounded margin. The dorsal fin origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the middle of the anal fin. The caudal fin has a shallow fork and pointed tips. The lower caudal fin lobe is larger than the upper lobe. The anal fin margin is straight to rounded and the fin does not reach back to the caudal fin base. The pelvic fin is rounded and almost or evidently reaches back to the anus. The pectoral fin is rounded and falls short or reaches the pelvic fin origin.

Dorsal fin unbranched rays 3, branched rays 7-9, modally 8, anal fin unbranched rays 3, branched rays 7-11, pectoral fin branched rays 12-14, and pelvic fin branched rays 7-8. Lateral line scales 35-45. There is a pelvic axillary scale. Scale shape is rounded with the dorsal and ventral margins merging into a posterior rounded margin. The anterior margin is rounded, or indented on each side of a central protrusion, or irregular in shape. Scales have a slightly anterior focus, numerous fine circuli, and relatively few to numerous radii on the anterior and posterior fields about equal in number. Anterior radii may be lacking. Total gill rakers number 12-16, reaching the first or second raker below when appressed. Pharyngeal teeth are 2,5-4,2, more rarely 2,4-5,2, 2,5-5,2 or 2,4-4,2, hooked at the tip and strongly serrated below on the larger teeth. The gut is an elongate s-shape and may have an anterior loop to the left. Total vertebrae number 37-39.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(5) or 8(20), anal fin branched rays 7(1), 8(7), 9(16) or 10(2), pectoral fin branched rays 12(8), 13(11) or 14(5), pelvic fin branched rays 7(22) or 8(3), lateral line scales 35(1), 36(-), 37(1), 38(5), 39(6), 40(6), 41(1), 42(2), 43(1), 44(-) or 45(2), total gill rakers 12(2), 13(7), 14(7), 15(4) or 16(6), pharyngeal teeth 2,5-4,2(9), 2,4-5,2(2), 2,5-5,2(1) or 2,4-4,2(1), and total vertebrae 37(4) or 38(1). Syntypes of *L. gaderanus* illustrated above all have 37 total vertebrae and syntypes of *L. ulanus* 38 and 39 total vertebrae.

Sexual dimorphism. Males bear obvious tubercles on the pectoral fins mostly in a single file, occasionally two together, branching with the rays. Tubercles also line the rays of the dorsal, pelvic and anal fins and weakly on the caudal fin, the rows branching with the fin rays. Small tubercles are also found thickly on the top and sides of the head but no pattern was discernible in the specimens examined (types of *L. ulanus*).

Colour. There is a narrow, straight black stripe running from the upper half of the eye to the end of the lateral line separating the bluish back from the silvery flanks (Günther, 1899), best developed in preserved specimens posteriorly. Live fish have a grey-silver flank with some spots, a brown-green back to dark olive brown to grey and a light silver abdomen. Scales on the upper flank anteriorly are outlined with pigment. Lower fins are pale to light yellow and the dorsal and caudal fins are light grey (Abbasi and Sabkara, 2004a, 2004b). The lower half of the operculum below the mid-eye level has few or no spots while the upper half is heavily pigmented. There is also no pigment below the eye or it is restricted to a thin line around this lower margin. The iris may have a ventral red spot. The flanks are dotted with minute pigment spots. The back mid-line has a black stripe, most obvious predorsally. The rays and membranes

of the dorsal fin, caudal fin and anterior pectoral fin bear melanophores, and melanophores are weak to absent on the anal and pelvic fins. The peritoneum is silvery brown with scattered melanophores.

Size. Reaches 14.2 cm fork length (Abbasi and Sabkara, 2004b).

Distribution. This species is endemic to the Lake Urmia basin (Günther, 1899). Recorded from the Baranduz, Gadar or Godar (= Qader), Halaj, Hasanlu, Mahabad, Mamiyand, Nazlu, Qader, Qodor (= Qader), Shahr, Sufi, Urmia and Zowla rivers, and the Hasanlu and Mahabad dams (Günther, 1899; Abdoli, 2000; Abbasi *et al*., 2005; K. Abbasi, pers. comm., 2012; Ghasemi *et al*., 2015).

This species was found only in the Gadarchai (= Qader River) and Mahabad River and was not caught in the Baranduz, Nazlu and Zola (= Zowla) rivers and sampled areas of the Simineh and Zarrineh rivers in recent collections by Abbasi and Sabkara (2004a, 2004b).

Zoogeography. *Alburnus kurui* (Bogutskaya, 1995) from the upper Tigris River system of Turkey is the closest relative of this species although other members of the Lake Urmia ichthyofauna are related to fishes from the Caspian Sea basin.

Habitat. This species is found in rivers, streams, lakes and dams.

Age and growth. Fish caught by Abbasi and Sabkara (2004b) in the Gadarchai (= Qader River) and Mahabad River were 34-142 mm in fork length and 1.4 years old. Males comprised 28.8% and females 71.2% of the total population. Maturity was attained at 2 years. Esmaeili *et al*. (2014) gave a *b* value for 30 fish from the Lake Urmia basin, 2.77-4.49 cm total length, as 2.55. Mouludi-Saleh *et al*. (2021) examined 156 fish, 3.8-9.7 cm total length, from the Godar and Mahabad rivers and recorded a *b* value of 3.04, isometric, and a condition factor of 1.25.

Food. Traces of insects, crustaceans, worms and large quantities of filamentous algae were found in the gut contents of a few specimens examined by me. The algae may be an accidental inclusion as the gut is short and probably cannot digest plant material. Fish caught by Abbasi and Sabkara (2004a, 2004b) however, contained a wide range of phytoplankton (19 genera) and zooplankton (7 groups), as well as benthic organisms (4 groups). *Daphnia*, *Chydrus* and chironomids were dominant gut contents. It was considered to be an omnivorous fish preferring to feed on zooplankton and other mid-water animals.

Reproduction. Spawning of fish caught by Abbasi and Sabkara (2004b) took place from 1 April until 1 July with absolute fecundity estimated at 1,810-16,115, average 6,437 eggs.

Parasites and predators. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G*. sp. in fish from the Baranduz and Halaj rivers.

Economic importance. None.

Experimental studies. None.

Conservation. Modern collections are few (see above and below). This suggests that it is now quite rare and/or has a restricted habitat preference. However, Jouladeh-Roudbar *et al*. (2020) listed it as of Least Concern as they included the widespread *A. atropatenae* as a synonym.

Sources. Type material:- *Leuciscus ulanus* (BM(NH) 1984.10.10:1-2) and *Leuciscus gaderanus* (BM(NH) 1899.9.30:108-112 and BM(NH) 1899.9.30:113-115).

Iranian material:- CMNFI 1970-0560, 35, 11.4-48.8 mm standard length, West Azarbayjan, Mamiyand Chay (ca. 36º59'N, ca. 45º39'E); CMNFI 2007-0096, 6, 38.8-68.5 mm standard length, West Azarbayjan, Baranduz Chay basin (ca. 37º25'N, ca. 45º10'E); CMNFI 2008-0225, 6, 53.1-65.0 mm standard length, Lake Urmia basin (no other locality data);

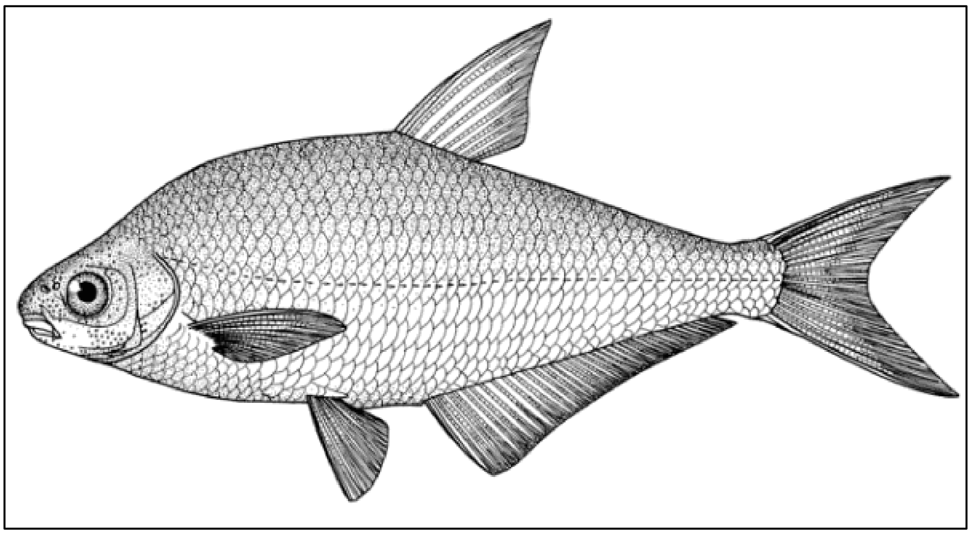
BM(NH) 1899.9.30:107, 1, 27.0 mm standard length, West Azarbayjan, Urmi River (no other locality data).

Genus *Ballerus*
Heckel, 1843

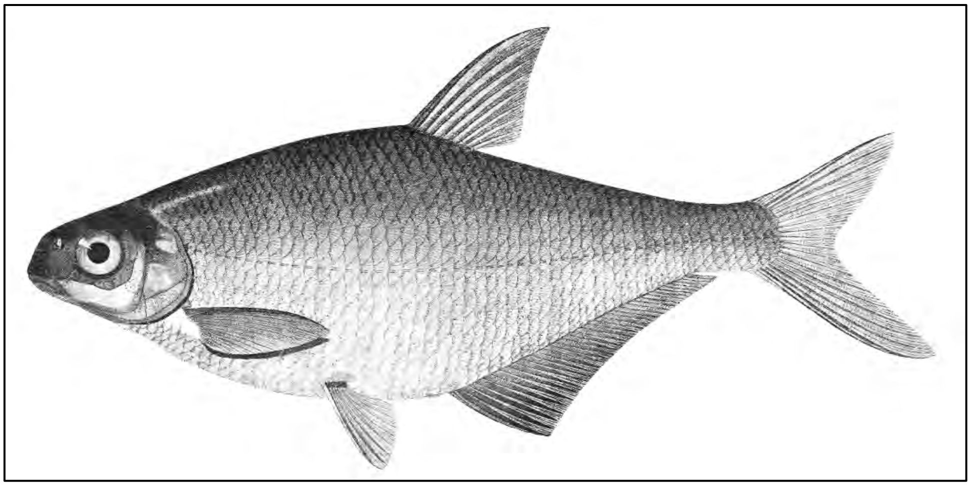
This genus comprises two species found in Europe and Southwest Asia in the North, Baltic, Black, Caspian and Aral Sea basins. One species is found in Iran. The species were formerly placed in the genus *Abramis*. This genus was resolved as the sister group to a clade including *Abramis*, *Acanthobrama*, *Blicca* and *Vimba* (Schönhuth *et al*., 2018).

The genus is characterised by a strongly compressed and deep body, a scaleless keel between the vent and pelvic fins, pharyngeal teeth in one row, dorsal fin short and spineless (8 branched rays modally), and anal fin very long (31-44 branched rays).

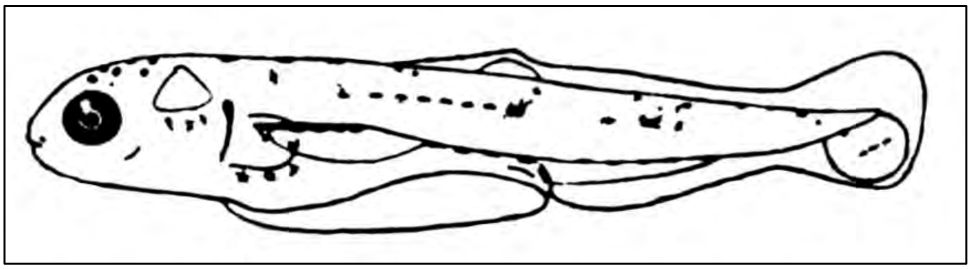
Ballerus sapa
(Pallas, 1814)



Ballerus sapa
Susan Laurie-Bourque @ Canadian Museum of Nature.



Ballerus sapa, Ukraine, Dnieper River at Kiev, after Berg (1916).



Ballerus sapa fry, age 10 days, Russia, Volga River delta , after Kazanskii (1928).

Ballerus sapa, Russia, Oka River (Volga River basin)
(CC BY-SA 3.0, rotated and cropped, Vladimir. Yu. Arkhipov, Arkhivov).

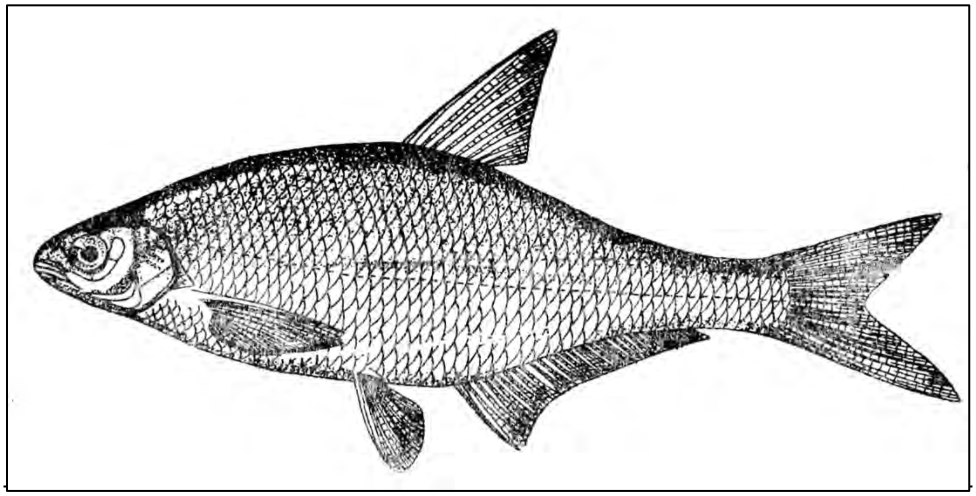
Common names. Mahi sim kondpuzeh (= bluntsnout silver fish), saba (from the species name), sim (= silver).

[Pori or poru, both in Azerbaijan; rybets, taran’ and tarashka erroneously in Azerbaijan (Berg, 1948-1949); sinets, yuzhnokaspiiskaya beloglazka or South Caspian white-eye bream in Russian; Danube bream, southern white-eye bream, white-eye bream].

Systematics. *Cyprinus Sapa* was originally described from the Sura, Samara and Kinel' rivers in the Volga River basin. No types known.

May be placed in the genera *Abramis* or *Ballerus* Heckel, 1843 (see Shcherbukha (1973), Hensel (1978), Howes (1981), Bogutskaya (1986) and Bogutskaya and Naseka (2004) for various opinions). The nominate subspecies was described from the Volga River and tributaries.

The subspecies reported from the southern Caspian Sea basin is *Abramis sapa bergi* Belyaev, 1929 (also spelled Belyaeff), described from the Kura River in Azerbaijan. Eschmeyer *et al*. (1996) date this subspecies to 1930 although the article is dated 1929, and this was corrected in the online *Catalog of Fishes* (downloaded 7 March 2018). Recognition of subspecies is disputable (Reshetnikov *et al*., 1997) and the *Catalog of Fishes* (downloaded 1 June 2021) lists it as a synonym of the type subspecies.



Abramis sapa bergi, after Abdurakhmanov (1962).

The status of this species in Iran should be assessed by field surveys. It is apparently quite rare and was not caught during two collecting trips along the Caspian shore in the 1970s. It is recorded only from two localities in Iran in 1929 and 1934.

Key characters. The scaleless keel on the belly, deep body, very high number of branched rays in the anal fin (31-44), modally 8 dorsal fin branched rays, and uniserial pharyngeal teeth are key characters.

Morphology. The body is compressed and very deep. It is deepest at, or just in front of, the dorsal fin origin. A nuchal hump is often present. The predorsal profile is convex to slightly convex, with a notch at the head and the head straight. The caudal peduncle is compressed and moderately deep but narrow in relation to the deep anterior body. The snout is thick, very rounded and convex, and falls back posteriorly to the upper lip. The mouth is subterminal and slightly oblique and extends back to the nostril level. Lips are thin. The eye is large and lies in the anterior half of the head. The dorsal fin margin is straight to slightly concave. The dorsal fin origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back to the level of the anterior to mid-anal fin. The caudal fin is deeply forked with pointed to rounded lobes. The lower caudal fin lobe is longer than the upper lobe and is more rounded. The anal fin is emarginate anteriorly, then straight and may become slightly convex at the end. The anal fin almost reaches back to the base of the caudal fin because of its length. The pelvic fin is rounded and may, or may not, reach back to the anal fin origin. The pectoral fin is rounded and may, or may not, reach back to the pelvic fin origin. These last two fins are longer in males.

Dorsal fin with 2-3, usually 3, unbranched and 7-9, usually 8, branched rays, anal fin with

3 unbranched and 31-44 (mostly 34-38 branched rays in Kura River fish after Berg (1948-1949)), pectoral fin branched rays 13-16, and pelvic fin branched rays 7-8. Lateral line scales 42-55, mostly 51-52 in the Kura River, regularly arranged over the body. A pelvic axillary scale is present. There is an evident, scaleless keel on the belly between the pelvic fin bases and the anal fin. Scale shape is squarish to very rounded with a rounded posterior margin, gently rounded dorsal and ventral margins and a wavy and irregular anterior margin. Anterior scale corners are rounded to sharp. Scales bear numerous very fine circuli, an almost central focus, numerous to few posterior radii (quite variable between scales of similar size) and few to none anterior radii. The anterior scale margin is wavy. Total gill rakers number 18-25, short, reaching the raker below or almost the second raker when appressed. Pharyngeal teeth are 5-5, with elongate, narrow and flattened, concave or rounded crowns below a hooked tip. The gut is s-shaped with a small anterior loop. Total vertebrae number 45-48. The chromosome number is 2n = 50 (Klinkhardt *et al*., 1995; Arai, 2011).

Belyaev (1929) for Kura River fish gave lateral line scale counts as 48(3), 49(6), 50(24), 51(50), 52(54), 53(16) or 54(7) and anal fin branched rays as 32(1), 33(5), 34(22), 35(32), 36(38), 37(47), 38(25), 39(9), 40(5), 41(2) or 42(1). The nominal Caspian Sea subspecies is distinguished from the type form in the Black Sea (Don River) by fewer lateral line scales and anal fin branched rays, a longer snout, smaller eyes, less deep body, lower dorsal fin, shorter anal fin, and longer postorbital length but is not recognised as distinct (see above).

Sexual dimorphism. Unknown.

Colour. The Caspian Sea population has a dark back with a bluish tint, flanks and belly are silvery, fins are a greyish-white and sometimes have a black margin (dorsal, anal and caudal fins), and the iris is silvery. The peritoneum is dark brown in preserved fish.

Size. Attains 41.0 cm and 0.8 kg.

Distribution. This species is found in the basins of the Black, Caspian and Aral seas. Reported from the Anzali Talab by Derzhavin (1934) but not captured in recent years (Holčík and Oláh, 1992). Other reports are from the lower Sefid River at Hasan Kiadeh (Belyaev, 1929; Derzhavin, 1934) and in the Aras River at Karadonly (Berg, 1948-1949). Jouladeh-Roudbar *et al*. (2020) considered reports from Iran might be misidentified *Abramis brama* and its presence needed confirmation.

Zoogeography. This species is part of a northern European and northern Southwest Asian fauna whose zoogeographical history has not been researched.

Habitat. This species is found in rivers, lagoons and brackish environments. It feeds in brackish water but spawns and overwinters in the lower reaches of rivers and is commonest along the western shore of the middle and southern Caspian Sea.

Age and growth. Females are 28-29 cm long on average, maximum 39 cm, while males are about 24 cm, maximum 30 cm (Belyaev, 1929). Males and females mature at 2-3 years and life span is 5 years in Azerbaijan (Abdurakhmanov, 1962).

Food. Food items include small molluscs, crustaceans and insect larvae as well as some plant fragments and detritus. Young feed on zooplankton.

Reproduction. A migration into rivers, particularly the Kura, occurred in winter when temperatures fluctuated from 5 to 10°C (Belyaev, 1929). The run began in November, peaked in January and ended in the middle of March. The Kura migration was once over 700 km from the mouth. Spawning occurred in rivers with gravel bottoms or dense vegetation from April to May. Fecundity reached about 150,000 eggs with diameters up to 1.8 mm. Eggs adhered to stones or plants.

Parasites and predators. This species is eaten by *Silurus glanis* (European catfish) (Derzhavin, 1934).

Economic importance. Up to 1-2 million fish were caught in the Kura at spawning (Belyaev, 1929). The annual average catch in Azerbaijan in 1931-1935 was 1,860,000 fish weighing 6,200 centners.

Experimental studies. None.

Conservation. The subspecies *A. sapa bergi* was proposed for inclusion in the "Red Book of the U.S.S.R." which formed the basis for measures to protect species (Pavlov *et al.*, 1985). This species has always been very rare in Iran and its absence from the Anzali Talab may be due to loss of spawning grounds (Holčík and Oláh, 1992). Lelek (1987) classified this species as rare to vulnerable in Europe. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Iranian material:- None.

Comparative material:- CMNFI 1986-0458, 2, 209.0-211.7 mm standard length, Germany, Danube River (48º58'N, 12º18'E); BC 59-301, 2, 136.3-154.2 mm standard length, Ukraine, Tisa, Danube drainage (no other locality data).

Genus *Blicca*

Heckel, 1843

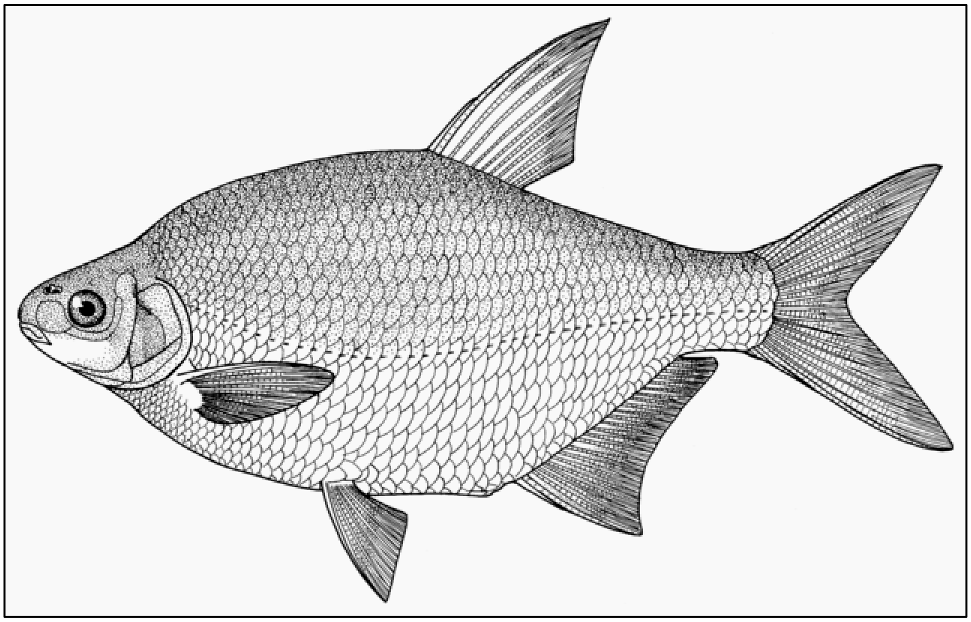
Shutov (1969) placed this genus and species in the genus *Abramis* Cuvier, 1816 on the basis of literature data as did analyses by Shcherbukha (1973) and Howes (1981). Hensel (1978) and Tadajewska (1998) also placed this genus in *Abramis* on the basis of the lateral line system structure, pharyngeal teeth, scale and dermal bone morphology along with data on ecology, behaviour, ontogenesis, osteology and parasitofauna. Hänfling and Brandl (2000) considered *Blicca* a junior synonym to *Abramis* based on allozyme data. In contrast, Bogutskaya (1986) using skull morphology reaffirmed its generic status.

The white bream genus contains a single species found from Europe to the Caspian Sea basin including Iran.

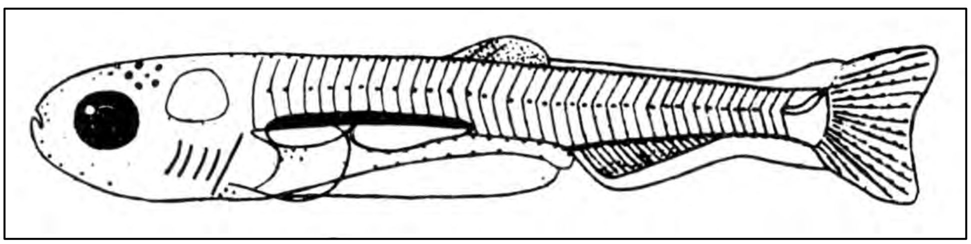
The genus is characterised by a deep and strongly compressed body, scales absent on the back behind the dorsal fin thus forming a narrow groove, a scaleless keel between the vent and the pelvic fins, pharyngeal teeth in two rows, a small, oblique and subterminal mouth, moderate number of gill rakers, scales of moderate size, a short and spineless dorsal fin and a long anal fin, and a light peritoneum.

Blicca bjoerkna

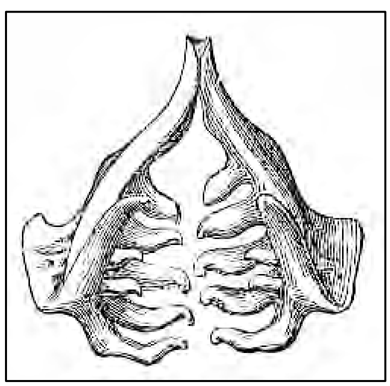
(Linnaeus, 1758)



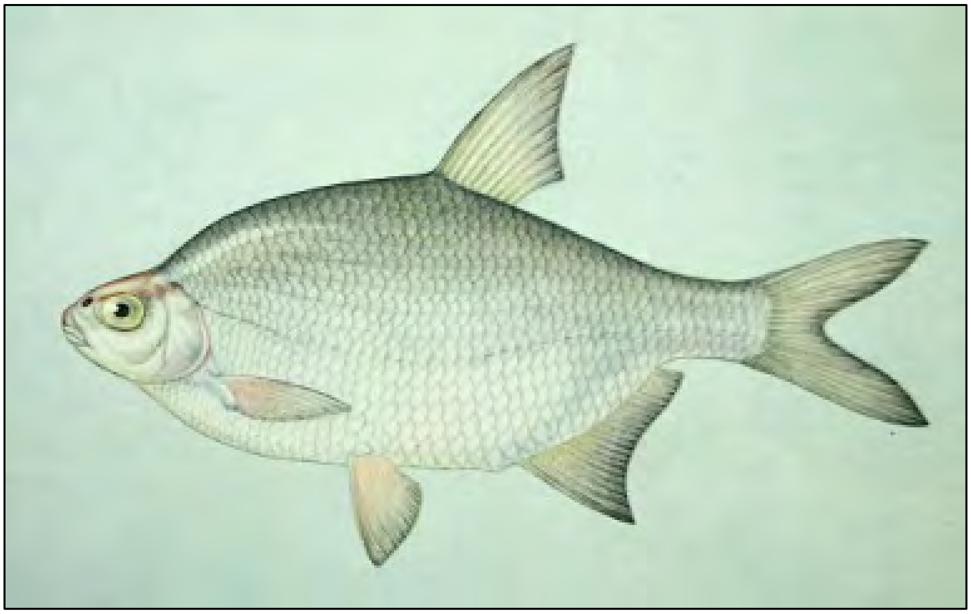
Blicca bjoerkna
Susan Laurie-Bourque @ Canadian Museum of Nature.



Blicca bjoerkna fry, 8.7 mm, age two weeks, Russia, Volga River delta, after Kazanskii (1915).



Blicca bjoerkna, pharyngeal teeth, after Seeley (1886).



Blicca bjoerkna
(CC0, NOAA Photo Library, N. N. Kondakov).

Blicca bjoerkna, Gilan, Anzali Wetland, November 2011, Keyvan Abbasi.

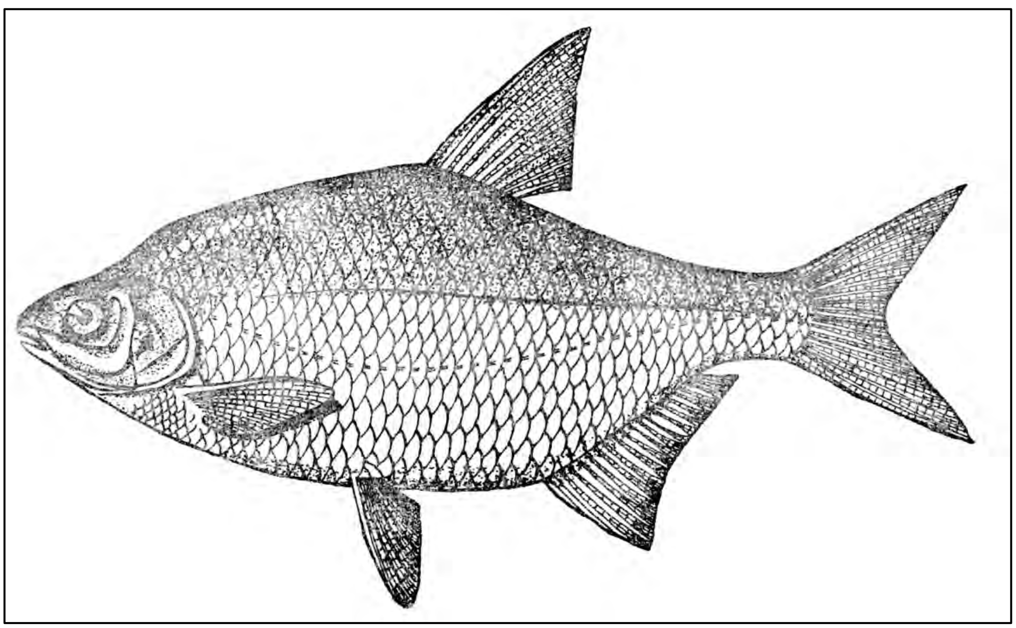
Blicca bjoerkna, ca. 30 cm**,** Netherlands, Waal River
(anal fin rounded from contact with hard bottom)
(SilverBreamBliccaBjoerknaCropped, CC BY-SA 3.0, Viridiflavus).

Common names. Simparak or seamparak (= silver scales, probable meaning since parak is a small feather), mahi sim nama or sim nama (= silvery-like fish or sim-like fish in reference to *Abramis brama*).

[Yastigarin in Azerbaijan; Tahta balığı in Turkish (Kaya *et al*., 2020); Zakavkazskaya gustera or Transcaucasian white bream, Armyanskaya gustera for *A. b. derjavini*, all in Russian; flat bream, silver bream, white bream].

Systematics. *Cyprinus Björkna* was originally described from Greifswald, Mecklenburg-Vorpommern, Germany. *Cyprinus Blicca* Bloch, 1782 described from lakes in Germany, *Cyprinus gibbosus* Pallas, 1814 described from the Sura and Volga rivers and *Blicca argyroleuca* Heckel, 1843 are synonyms. It appears that the latter taxon is first described in Heckel's work on fishes of Syria, but in the section devoted to classification based on the pharyngeal teeth of cyprinids; the taxon is later described from Europe in Heckel and Kner (1858) and is not a Southwest Asian species. Syntypes of *Blicca argyroleuca* are in the Naturhistorisches Museum Wien under NMW 16901 (2 fish), NMW 54918 (6), NMW 54919 (4) and NMW 54920 (1) (Eschmeyer *et al*., 1996). The spelling *bjorkna* is incorrect (Eschmeyer *et al*., 1996).

The Caspian Sea basin subspecies is *Blicca bjoerkna transcaucasica* Berg, 1916, described from the lower reaches of the Kura River, Aras, Lenkoran District, Transcaucasia. It is distinguished by "somewhat" fewer rays in the anal fin (17-21) and "a tendency to have" fewer lateral line scales (40-45) than in the type form which mostly has 21-22 anal fin rays and 45-48 lateral line scales (Berg, 1948-1949). Abdurakhmanov (1962) expanded these ranges to 17-22 and 40-48 respectively but gave low means (± standard error) for 100 fish from Azerbaijan of 19.88±0.13 and 43.56±0.05 respectively. This may be a valid subspecies but the possibility of clinal variation has not been examined.



Blicca bjoerkna transcaucasica, after Abdurakhmanov (1962).

Blicca bjoerkna derjavini Dadikyan, 1970 is described from the "Sevdzhur River, (tributary of Aras River, in Armenian SSR) and the canal and lake system connected with it". It is distinguished from *transcaucasica* by lower mean number of dorsal fin branched rays and branched anal rays, a higher mean lateral line scale count, and various morphometric characters.

The *Catalog of Fishes* (downloaded 1 June 2021) considers both subspecies to be synonyms of *Blicca bjoerkna*.

Key characters. The scaleless ventral keel, postdorsal scaleless groove, long anal fin, lateral line scale count and small and oblique mouth are characteristic.

Morphology. The body is compressed and very deep, being deepest at the dorsal fin origin. A nuchal hump is present. The predorsal profile is convex with the head set off from the back by a dip. The head is small. The caudal peduncle is compressed and deep. The snout is rounded and protrudes beyond the upper lip. The rear of the eye is positioned at the beginning of the anterior half of the head. The mouth is subterminal and lips are moderately thick. The dorsal fin margin is slightly concave. The dorsal fin origin lies well posterior to the level of the origin of the pelvic fin. The depressed dorsal fin reaches back to a level with the middle or more of the anal fin. The caudal fin is deeply forked with pointed lobes, the lower lobe being slightly more rounded. The anal fin is emarginate and does not extend back to the caudal fin base. The pelvic fin is rounded and extends almost back to, or back to, the anal fin origin. The pectoral fin is rounded and does not extend back to the pelvic fin origin, or almost reaches that fin or overlaps it.

Dorsal fin with 3 unbranched and 7-10 branched rays, usually 8, anal fin with 3 unbranched and 16-24 branched rays, pectoral fin branched rays 14-16, and pelvic fin branched rays 7-9. Lateral line scales 40-55. There is a pelvic axillary scale. Scales have numerous fine circuli, an almost central focus, a wavy anterior margin and a crenulate posterior margin, and few primary anterior and posterior radii, as few as two in each field (there may be numerous secondary radii which do not reach the focus). Total gill rakers number 12-21, touching the adjacent raker when appressed. Pharyngeal teeth are 2,5-5,2 with variants 2,5-5,1, 1,5-5,2, 1,5-5,1, 2,5-4,2, 2,5-4,1, 1,5-4,1, 3,5-5,2, and 3,5-5,3 (among others, see below and Tadajewska (1998)), weakly hooked (strongly hooked in young), compressed, concave below the tip and smooth (anterior tooth margin serrated in young). In young fish, the first major row tooth may be medial to the second tooth rather than in line. Tadajewska (1998) gave details of tooth development. The intestine is s-shaped with a small anterior loop. Total vertebrae number 37-43. The chromosome number is 2n = 50 (Klinkhardt *et al*., 1995; Pourkazemi *et al*., 2010; Arai, 2011).

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(49) or 9(1), anal fin branched rays 17(3), 18(15), 19(21), 20(9) or 21(2), pectoral fin branched rays 14(15), 15(24) or 16(7), pelvic fin branched rays 7(1), 8(47) or 9(2), lateral line scales 41(2), 42(10), 43(9), 44(13), 45(10), 46(5) or 47(1), total gill rakers 13(2), 14(25), 15(18), 16(4), 17(-) or 18(1), pharyngeal teeth 2,5-5,2(3), 2,5-5,1(4), 1,5-5,2(4), 2,5-4,1(1), 2,5-5,0(1), 0,5-5,2(1), 1,5-5,1(1), 1,5-5,0(2), 1,5-4,1(2) or 2,4-4,1(1), and total vertebrae 38(8), 39(33) or 40(12).

Sexual dimorphism. Breeding males have fine tubercles on the top of the head, operculum and lining the exposed scale margins on the flank. There are occasionally tubercles in mid-scale. Small tubercles are found on the pectoral fin rays, 1-3 rows on the unbranched ray, 1-2 on the first branched ray and usually one on the other rays, branching to follow the branching rays. Other fins bear fine tubercles following the fin rays. Larger tubercles are found in clumps on the scales overlapping the anal fin base. Tubercles are absent from the belly. CMNFI 1979-0472 (63.6 mm standard length, 4 July 1978) has fine tubercles on all head surfaces and on all scales, and on the pelvic fin rays but less developed than on other fins. Fine unculi are present on the snout, under the eye and between the tubercles on the head generally as well as on the underside of the pectoral fin.

Colour. The back is a bluish-green and the rest of the body silvery. The pectoral and pelvic fins are orange-red with grey tips. The peritoneum is silvery with scattered melanophores.

Size. Reaches 54.5 cm and 2.13 kg, perhaps 2.25 kg (Machacek (1983-2012), downloaded 27 July 2012). Berg (1948-1949) gave 20.5 cm for *B. bjoerkna transcaucasica*.

Distribution. Found from England through Europe north of the Alps and Pyrenees to the Caspian Sea basin. Apparently, it does not penetrate to the higher reaches of even major rivers like the Kura and Aras. In Iran it is found from the Aras River (including its middle reaches in Iran) to the Atrak River in the Caspian Sea basin including the Babol, Chapak, Golshan, Gorgan, Haraz, Masuleh, Nahang, Nerissi, Pesikhan, Pir Bazar, Rasteh, Sardab, Sefid, Shah, Sheikan, Shesh Deh, Siah Darvishan, Sowsar, Tajan, Tonekabon and Zarrin Gol rivers, the Anzali Talab, Boojagh and Amirkelayeh wetlands, a swamp near Hendeh Khaleh, the Aliabad and Aras dams, and the Caspian Sea near Bandar-e Anzali and Babol Sar (Derzhavin, 1934; Holčík and Oláh, 1992; Nejatsanatee, 1994; Karimpour, 1998; Abbasi *et al*., 1999, 2007, 2017; Kiabi *et al*., 1999; Nasrollahzadeh, 1999; Abdoli, 2000; Abdoli and Naderi, 2009; Tajbakhsh *et al*., 2010; Khara *et al*., 2011; Eagderi *et al*., 2020).

Zoogeography. This species is part of a northern European and northern Southwest Asian fauna whose zoogeographical history has not been thoroughly researched. The relationships with similar genera are reviewed under the genus.

Habitat. This species is found in rivers, streams, lakes, dams, lagoons, marshes and brackish environments. It is often found in the shallows of warm lakes with heavy vegetation and in the slower reaches of rivers including river estuaries in Iran (Naderi Jolodar and Abdoli, 2004). It overwinters in deeper water. There was a mass mortality of this species on the Babol Sar beach on 24 June 1963 (USNM 271217). Collection data included a temperature range of 14.2-24ºC, pH 6.0, conductivity 0.8 mS, river width 8-20 m, still to fast current, depth 40-50 cm, mud, clay, sand, pebble or stone bottoms, encrusting, submergent and emergent vegetation including *Ceratophyllum*, *Potamogeton*, *Phragmites* and *Ranunculus*, and a grassy shore.

Age and growth. Growth is slow with maturity attained at 3-5 years and 10-12 cm. Some males may mature at 2 years. Females are much larger than males of the same age. Life span is up to 16 years. Stunted populations comprising large numbers of individuals develop where predators are absent. Jamali *et al*. (2015) examined fish from Aras Dam and found a maximum age of 5^+ years with the most frequent age class 2^+ years. The length-weight relationship was $W = 1E\text{-}06TL^{3.44}$ for females, $W = 1E\text{-}06TL^{3.45}$ for males and $W = 1E\text{-}06TL^{3.44}$ for sexes combined (positive allometric growth for all). The sex ratio was 1:1.42 in favour of males and the calculated maximum condition factor was 0.34 in males and 0.37 in females. Farzi and Fallahkar (2018) found growth in the Anzali Wetland was positively allometric. Eagderi *et al*. (2020) examined 392 fish, 13.7-27.8 cm total length, from the Aras River and found a *b* value of 3.44, positively allometric.

Food. Food items included insect larvae such as chironomids, worms and molluscs, and some vegetation. This is a euryphagous species. Young fish fed principally on copepods and cladocerans. Even adults fed on plankton and it was less of a bottom feeder than *Abramis brama*.

Reproduction. Spawning in the Volga delta took place about the beginning of May at around 11°C water temperature but may run from the end of April to the middle of July in the Volga generally. Spawning in the Aras flood plain occurs in the middle of April. Generally spawning occurs later than in *Abramis brama* and *Rutilus rutilus* (possibly *R. lacustris*) but may overlap and infertile hybrids result. Shallow weedy areas were preferred. Each female was pursued by several males. Fecundity reached 109,000 eggs and egg diameter 1.44 mm. Eggs

adhered to plants or stones on the bottom. There could be three spawnings at intervals of 10-11 days when water temperatures were at least 16-17°C. Batch spawning showed much individual variation as well as varying between localities and by year at the same locality.

Parasites and predators. Khara *et al*. (2006a) recorded the digenean eye fluke *Diplostomum spathaceum* for this fish in the Amirkelayeh Wetland in Gilan as did Khara *et al*. (2008) in fish from Boojagh Kiashahr Wetland in Gilan. Barzegar *et al*. (2008) also recorded this eye parasite. Tajbakhsh *et al*. (2010) reported the nematode *Philometra rischta* from fish in the Anzali Wetland. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea* sp. on this species. Khara *et al*. (2011) listed the monogenean *Dactylogyrus* sp. and the crustacean *Lernaea cyprinacea* from this fish in the Boojagh Wetland of the Caspian Sea. Pazooki *et al*. (2011) examined fish from the Anzali Talab and found *Trichodina perforata*, *Myxobolus musayevi*, *Dactylogyrus difformis*, *D. sphyrna*, *Diplostomum spathaceum*, *Posthodiplostomum cuticula*, *Ripidocotyle* sp., *Contracaecum osculatum*, *Philometra rischta* and *Raphidascaris acus*, more than in the introduced *Hemiculter leucisculus*. Mirhashemi Nasab *et al*. (2017) found *Diplostomum spathaceum* in fish from the Anzali Wetland with the highest prevalence (70%) and range (1-66 worms in a fish) of eight species examined. Moumeni *et al*. (2020) recorded the zoonotics *Contracaecum osculatum* and *Philometra rischta* from this species in Iran.

The Caspian seal, *Pusa caspica*, is a predator on this species (Krylov, 1984) as are a variety of other fishes such as perch (*Perca fluviatilis*) and pike-perch (*Sander* sp.). *Silurus glanis* (European catfish) eats this species in the Boojagh Wetland in the spring and summer (Ershad Langroudi *et al*., 2017). Ashoori *et al*. (2012) found that grey herons (*Ardea cinerea*) in the Siahkeshim Protected Area of the Anzali Wetland ate this species and Ashoori *et al*. (2017a) recorded this species as the third most dominant in the diet of young black-crowned night herons (*Nycticorax nycticorax*) in the Anzali Wetland. Mirzajani *et al*. (2021) found the Eurasian otter (*Lutra lutra*) ate this species in the Anzali Wetland where it comprised 47% of the fish diet.

Economic importance. Holčík and Oláh (1992) reported a catch of 144 kg in the Anzali Talab in 1990. Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use in aquaria and in textbooks.

Experimental studies. None.

Conservation. Lelek (1987) classified this species as intermediate in Europe (liable to be transferred to vulnerable or rare categories if their habitat deteriorates further). Kiabi *et al*. (1999) considered this species to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, abundant in numbers, habitat destruction, widespread range (75% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Iranian material:- CMNFI 1970-0510, 1, 56.0 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0521, 1, 45.2 mm standard length, Gilan, Sefid River near Lulaman (no other locality data); CMNFI 1970-0522, 4, 40.0-62.6 mm standard length, Gilan, Sefid River at Astaneh Bridge (36º16'30"N, 49º56'E); CMNFI 1970-0532, 6, 30.0-63.2 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0553, 4, 62.1-80.1 mm standard length, Gilan, Sowsar Roga River (37º27'N, 49º30'E); CMNFI 1970-0579, 2, 52.6-56.9 mm standard length, Gilan, Old Sefid River estuary (37º23'N, 50º11'E); CMNFI 1970-0580, 31, 31.8-86.3 mm standard length, Mazandaran, river near Iz Deh (36º36'N, 52º07'E); CMNFI 1970-0582, 1, 70.9 mm standard length, Golestan, Aliabad

Reservoir (*sic*) (36º56'N, 54º50'E); CMNFI 1970-0585, 39, 32.4-52.5 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0587, 36, 34.6-55.4 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0590, 6, not kept, Mazandaran, Shesh Deh River near Babol Sar (ca. 36º43'N, ca. 52º39'E); CMNFI 1979-0470, 2, 44.5-51.2 mm standard length, Mazandaran, stream 21 km west of Alamdeh (36º35'N, 51º43'E); CMNFI 1979-0472, 30, 38.7-69.6 mm standard length, Mazandaran, stream 7 km west of Mahmudabad (36º37'N, 52º12'E); CMNFI 1979-0685, 3, 63.1-67.1 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1980-0116, 3, 39.0-49.4 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0117, 1, 80.0 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0122, 15, 38.7-45.3 mm standard length, Mazandaran, Nerissi River (36º38'N, 52º16'E); CMNFI 1980-0125, 21, 39.8-53.2 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1980-0130, 2, not kept, Mazandaran, Iz Deh near Shilat Post (36º36'N, 52º07'E); CMNFI 1980-0149, 6, 60.1-63.7 mm standard length, Gilan, Chapak River (37º21'N, 49º50'E); CMNFI 2008-0110, 1, 63.2 mm standard length, Gilan, swamp near Hendeh Khaleh (37°23'N, 49°28'E).

Genus *Chondrostoma*

Agassiz, 1832

The nases are found from the Iberian Peninsula and France to the Caspian Sea, Tigris-Euphrates and internal Iranian basins. There are about 27 species of which four are known for Iran (note that some European species have been placed in new genera (Corse *et al*., 2015; Küçük *et al*., 2017)). *Chondrochylus* Heckel, 1843 and *Chondrochilus* Heckel, 1843 are synonyms. Eschmeyer (1990) gave the year of publication for the genus as 1832 as opposed to other authors who gave 1835 (e.g., Berg, 1948-1949; Reshetnikov *et al*., 1997). Doadrio and Carmona (2004) confirmed the monophyly of the genus based on the cytochrome *b* gene with vicariant events accounting for distribution of taxa better than a dispersalist model. Middle East taxa belong to a single lineage with the more differentiated and basal species in the Caucasus and Mesopotamia, having been isolated in the Upper Miocene-Pliocene. Çiftci *et al.* (2020) gave a phylogeography of the genus in Anatolia using cytochrome *b*. *C. cyri* and *C. regium*, the only Iranian species examined, were in their own clades in different haplogroups. A Regium lineage (including *C. regium*) diverged from its sister group, the Nasus lineage (including *C. cyri*) approximately 4.77 MYA. Separation of *C. cyri* within the Nasus lineage occurred 1.37 MYA. Speciation events in the Regium lineage took place between the Late Pliocene and Early Pleistocene, a period coinciding with the uplifting of the Anatolian plateau 2.5-3.0 MYA.

This genus is characterised by being of moderate size, with a somewhat compressed body, scales of moderate to small size (44-106 in the lateral line (Robalo *et al*. (2007) gave a range of 52-78 for their more restricted genus)), scales squarish with radii in the anterior and posterior fields and a subcentral anterior focus, no barbels, an inferior and transverse or crescentic mouth with a cutting edge to the lower jaw, thin upper lip and no lower lip, pharyngeal teeth knife-like and in one row with a high count (5, 6 or 7, the same number on each arch or one more on the left or right), gill rakers short and moderately numerous (up to 40), a short dorsal fin without a thickened ray opposite the pelvic fins, 7-10 dorsal fin branched rays, a moderately elongate anal fin with 8-12 branched rays, deeply forked caudal fin and usually concave dorsal and anal fins, a pelvic axillary process always present, 42-49 total vertebrae, a black peritoneum, and a long, coiled gut. Elvira (1997) and Robalo *et al*. (2007) gave

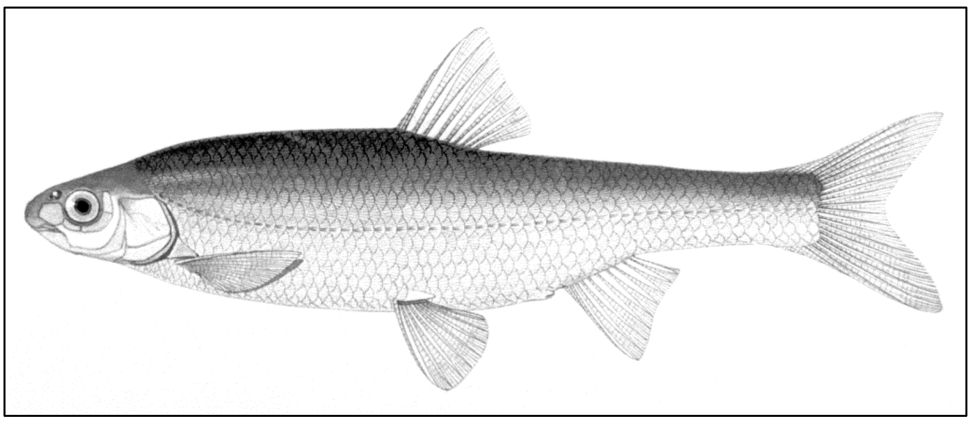
osteological characters and Jouladeh-Roudbar (2014) gave an overview of the Iranian species using morphological and molecular characters.

Bogutskaya (1997) placed the Iranian species, *C. regium* and *C. orientale*, in a group characterised by a straight or only slightly arched mouth cleft, high vertebral counts (total vertebrae modes 45-47 and abdominal modes 26-28) and often or commonly 4 unbranched rays in the dorsal fin.

These fishes exhibit trophic and habitat use morphological differences, from diet generalists to diet specialists for example, and show adaptive evolution (Corse *et al*., 2015).

Species/ Characters	Dorsal fin branched rays	Lateral line scales	Total gill rakers	Lower jaw horny edge	Distribution
C. cyri	8	48-73	17-32	Present	Caspian Sea
C. esmaeilii	8	51-58	15-17	Absent	Tigris River
C. orientale	8	47-57	25-34	Present	Kor River
C. regium	8-9	50-73	17-36	Present	Esfahan, Persis, Tigris River

Chondrostoma cyri
Kessler, 1877



Chondrostoma cyri, Georgia, Kura River at Borzhomi (= Borjomi), after Berg (1932b).

Chondrostoma cyri, Iran, Aras River, March 2012, Keyvan Abbasi.

Chondrostoma cyri, Turkey, Kars Stream, Aras River basin
(CC BY 4.0 after Kaya *et al*. (2020)).

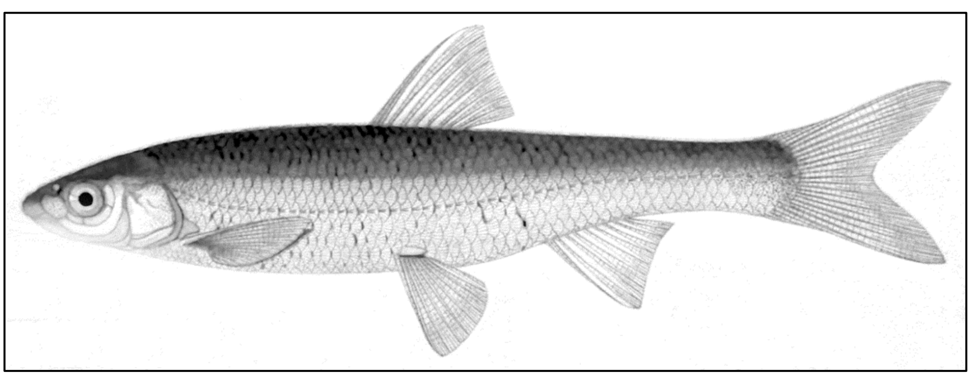
Common names. Mahi-ye nazok-e Aras (= slender Aras fish), shekamsiah-e Aras (= Aras black belly).

[Kur altagizi in Azerbaijan; Kura kababurunu in Turkish (Kaya *et al*., 2020); chernobryushka or blackbelly, Kurinskii podust or Kura nase, uzkotelii Kurinskii podust, all in Russian; blackbelly undermouth, Kura nase, Kura undermouth, Southern Caspian nase].

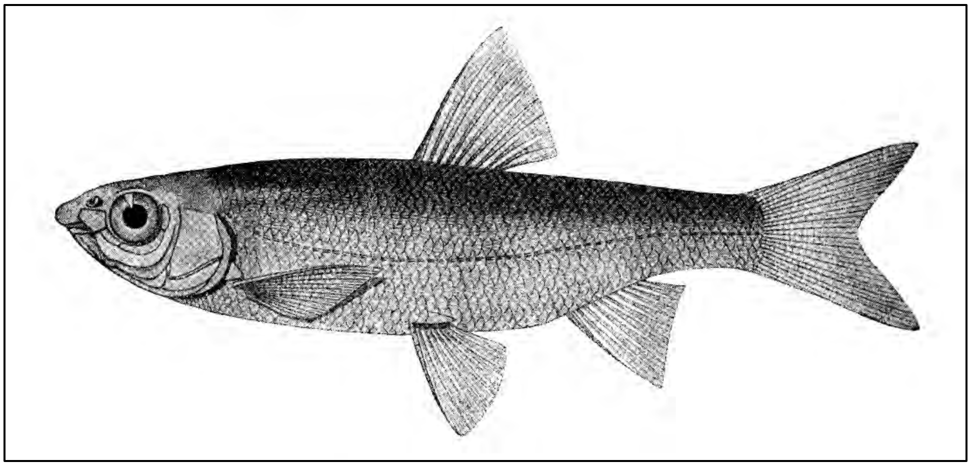
Systematics. Earlier works by Elvira (1986, 1988, 1991) placed this species as a subspecies of *C. oxyrhynchum* Kessler, 1877 but in Elvira (1997), using the phylogenetic species concept and following the studies of Smirnov (1992), this taxon was recognised as a species. *C. oxyrhynchum* is then found in more northerly rivers of the western Caspian Sea basin remote from Iranian waters. *C. cyri orientalis* Bianco and Banarescu, 1982 was described from Fars (see below under *C. orientale*).

Chondrostoma cyri Kessler, 1877 was described from the Kura River, Tiflis (= Tbilisi), Georgia and *Chondrostoma oxyrhynchum* from the Kuma River near Georgiyevsk, Russia in the Caspian Sea basin.

Alburnus alasanicus Kamensky, 1901 described in part from the Alasan, Alazan’ or Alazani River, a left bank Kura River tributary in Georgia, *Chondrostoma schmidti* Berg, 1910 from the Alazan' River at Napori ri and *Chondrostoma leptosoma* Berg, 1914 from the Kars-tchai, a tributary of the Aras River in Turkey, the Aras by Kopri-kei, near Erzurum, Turkey, and the lower Aras at Karadonly and Dzhulfa (latter on the Iran border, the Iranian town opposite being Jolfa) in the former U.S.S.R. are synonyms of *C. oxyrhynchum* according to the *Catalog of Fishes* (downloaded 1 June 2021) but zoogeographically would seem to be *C. cyri* synonyms. *C. leptosoma* was founded on an elongate form from the Karasu in the Aras River basin. Berg (1948-1949) recognised *C. schmidti* as distinct with *C. alasanicus* as a synonym.

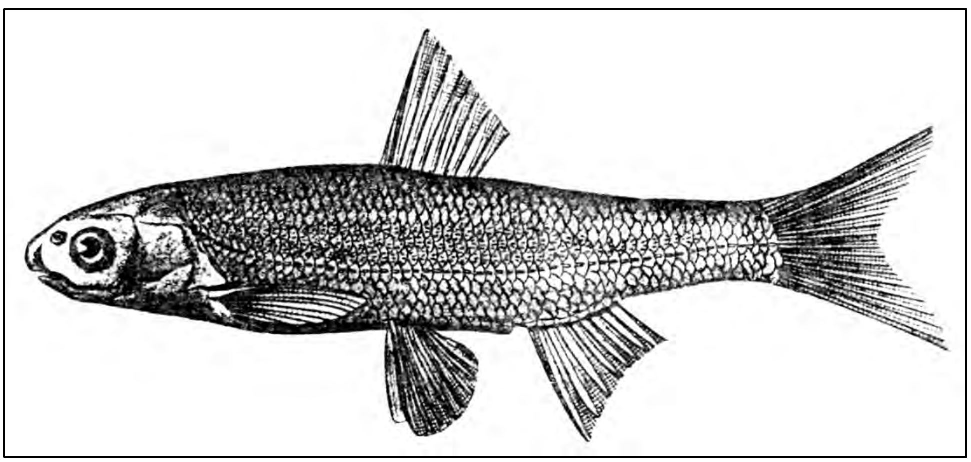


Chondrostoma leptosoma, syntype, 15.7 cm total length, ZISP 15516,
Azerbaijan, Aras River at Dzhulfa (= Julfa), after Berg (1948-1949).



Chondrostoma schmidti, 10.6 cm total length, Georgia, Alazan' River at Naporiri, after Berg (1932).

Two syntypes of *Chondrostoma cyri* are under ZISP 10919 from “Tiflis” collected by Kessler in September 1875. A syntype of *Chondrostoma oxyrhynchum* is in the Zoological Institute, St. Petersburg (ZISP 2881) from “Fl. Sunsha” collected in 1830 by Ménétries. According to Elvira (1988), the type locality is the Kuma R. at Georgijewsk and two syntypes are under ZISP 10922. Another syntype of *Chondrostoma oxyrhynchum* is in the Natural History Museum, London (BM(NH) 1897.7.5:28, 184.8 mm standard length), formerly in ZISP, as is other syntype of *Chondrostoma cyri* (BM(NH) 1897.7.5:27, correctly numbered 27, 78.4 mm standard length), formerly in ZISP (Elvira, 1988; personal observations).



Chondrostoma cyri, syntype, after Kessler (1877).

Five syntypes of *Chondrostoma leptosoma* are in the Zoological Institute, St. Petersburg (ZISP 9098) according to (Elvira, 1988) but there are 15 syntypes under this number from the “Reka Araks”, 1888, Warpochowsky as well as additional material listed as syntypes with numbers ZISP 9099 (“Reka Araks”, 1888, Warpochowsky, 4 fish), ZISP 9107 (“Fl. Araxes”, 1888, Warpochowsky, 12 fish, but now 4 in the *Catalog of Fishes*, downloaded 1 June 2021), ZISP 5180 ("Kars-tschai", 1879, Dr. A. Brandt, 3 fish), ZISP 15264 (“Reka Araks”, 20.III.1911, 2 fish), and ZISP 15516 (“Reka Araks near settlement Djulfa”, 17.VI.1911, 13 fish, but 6 in the *Catalog of Fishes*, downloaded 1 June 2021).

Two syntypes of *Alburnus alasanicus* may be in ZMT (S. Janashia State Museum of Georgia, Zoological Section, Georgian Academy of Sciences, Tbilisi, Georgia), none in the Zoological Institute, St. Petersburg, and no types are listed for *Chondrostoma schmidti* (*Catalog of Fishes*, downloaded 1 June 2021).

Key characters. This species is the only one in its genus in northern Iran and can be recognised by generic characters. The snout is long (25.5% of head length or more), dorsal fin branched rays are usually 8, anal fin branched rays usually 9-10, lateral line scales 48-73, and total gill rakers usually 21 or more.

Morphology. The body is moderately elongate and its depth exceeds head length. The body is deepest in front of the dorsal fin. The predorsal profile is convex. The dorsal head profile is straight to rounded. The caudal peduncle is compressed and moderately deep. The mouth is strongly arched, slightly wider than or as wide as the eye, with a thin horny layer on the lower jaw. Smaller fish have a u-shaped mouth. The snout projects slightly, overlapping the upper lip. Lips are of moderate thickness. The eye is in the anterior half of the head. The dorsal fin margin is straight. The dorsal fin origin lies over or anterior to that of the pelvic fin. The depressed dorsal fin reaches back level with the anal fin origin or falls short. The caudal fin is moderately forked, with pointed to rounded tips and the lower lobe larger. The anal fin is emarginate to straight and the fin does not reach back to the caudal fin base. The pelvic fin is rounded and does not extend back to the anus or just reaches the anterior anal papilla. The pectoral fin is rounded and does not extend back to the pelvic fin.

Kuru (1981) gave the following meristic characters for 103 specimens from the Aras and Kura river basins in Turkey:- 10-12 dorsal fin rays, 10-11 anal fin rays, 9-10 pelvic fin branched rays, 9-15 pectoral fin branched rays, and lateral line scales 52-62 with 13-18 scales around the caudal peduncle. There is clinal variation in scale numbers, the number increasing from south to north. Note that the statistical treatment in this paper is in error and the conclusion that species of *Chondrostoma* in Turkey are not distinct is therefore incorrect. There is a pelvic axillary scale. Scales are rounded in overall shape with indentations above and below a central, rounded protuberance on the anterior margin. The anterior margin may be wavy. There are few anterior and posterior radii, few circuli and a subcentral anterior focus. Total gill rakers number 17-32. There are 5-6 pharyngeal teeth on each arch. Elvira (1988, 1991) gave the total range for characters of this species as dorsal fin branched rays 7-9, usually 8, anal fin branched rays 8-10, usually 9-10, pectoral fin branched rays 13-18, usually 14-16, pelvic fin branched rays 7-8, usually 8, lateral line scales 50-68 (to 73 in Kazancheev (1981) and from 48 in Chikova (1967)), scales above the lateral line 7-10, usually 8-10, scales below the lateral line 3-6, usually 4-6, pharyngeal teeth 6-5 or 5-5, more rarely 6-6 and mode 6-5, and total gill rakers 21-29 (to 30 in Eagderi *et al.*, 2017). The gill rakers are short and reach the one below or just past it when appressed. Pharyngeal teeth are compressed and thin but deep with a long, thin and concave grinding surface. Teeth tips may be slightly hooked. The gut has numerous anterior loops. Total vertebrae number 43-45.

Thirteen specimens from Djulfa (presumably in Azerbaijan opposite the Iranian town across the Aras River) had dorsal fin branched rays 8(12) or 9(1), anal fin branched rays 9(9) or 10(4), and pharyngeal teeth 6-5(5) or 6-6(1).

Moezi and Keivany (2020) described the osteology of this species.

Sexual dimorphism. Unknown.

Colour. The flanks are silvery but may have dark pigment spots which may, or may not, form a stripe. Paired fins are orange to reddish and median fins grey to reddish. The dorsal and

caudal fins have dark margins. The peritoneum is black.

Size. Reaches 80.0 cm and about 5.0 kg.

Distribution. This species is found in the rivers draining to the western coast of the Caspian Sea principally the Kura and Aras river basins in the south. Recorded from the Aras River basin of Iran (Abdoli, 2000). Jouladeh Roudbar *et al*. (2014c) confirmed presence in the Aras River based on DNA barcoding.

Zoogeography. This genus has a European and Middle Eastern distribution. Its relationships to other taxa are poorly known.

Habitat. Found principally in streams and rivers, habitat details are unknown for Iran

Age and growth. Fish are mature at 2 years of age and life span is at least 5 years. Abbasi *et al*. (2019) gave a *b* value of 3.05 for 68 fish, 10.3-25.2 cm total length, from the Aras River.

Food. Diet is assumed to consist of bottom organisms including aquatic insect larvae, detritus and vegetation scraped from the substrate.

Reproduction. Up to 16,217 eggs are produced and maximum diameter is 1.69 mm. The spawning season is in the spring, peaking in April in the Kura River basin (Abdurakhmanov, 1962).

Parasites and predators. None reported from Iran.

Economic importance. None.

Experimental studies. None.

Conservation. Kiabi *et al*. (1999) considered this species to be conservation dependent, in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, possibly few in numbers, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and absent outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Type material:- *Chondrostoma cyri* (BM(NH) 1897.7.5:25), *Chondrostoma leptosoma* (ZISP 15516) and *Chondrostoma oxyrhynchum* (BM(NH) 1897.7.5:28).

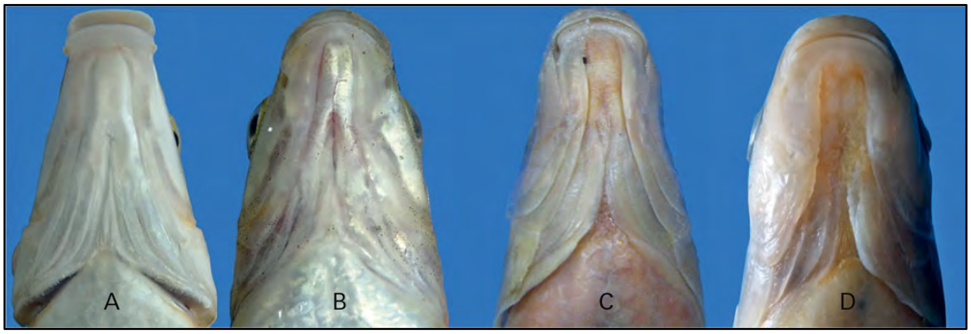
Iranian material:- None.

Comparative material:- CMNFI 1980-0812, 2, 101.9-107.9 mm standard length, Turkey, Kars, Selim Çayi (40º28'N, 42º47'E).

Chondrostoma esmaeilii

Eagderi, Jouladeh-Roudbar, Birecikligil, Çiçek and Coad, 2017

Chondrostoma esmaeilii, paratype, 104.0 mm standard length,
IMNRF-UT 1045-2, Kermanshah, Sarab-e Ravansar Stream, after Eagderi *et al*. (2017).



Ventral heads of *Chondrostoma* species, A = *C. regium*, 221.0 mm standard length, B = *C. esmaeilii*, 125.0 mm standard length, C = *C. orientale*, 152.0 mm standard length, D = *C. cyri*, 207.0 mm standard length, after Eagderi *et al*. (2017).

Common names. None.

[Esmaeili's nase, Tigris nase].

Systematics. The holotype is deposited in the Ichthyological Museum of Natural Resources Faculty, University of Tehran under IMNRF-UT 1045-1, female, 136.4 mm standard length) from Kermanshah Province, Ravansar, Sarab-e Ravansar Stream, 34°42′38″N 46°39′14″E, and 10 paratypes, 91.0-120.3 mm standard length, are under IMNRF-UT 1045, same data as holotype. The species is named for and dedicated to Professor Dr. Hamid Reza Esmaeili, Shiraz University. Jafari *et al*. (2017) distinguished this species from *C. regium* morphometrically. Jouladeh-Roudbar *et al*. (2014, 2015) referred to an undescribed species from the Tigris River basin which was this species.

Key characters. This species is distinguished from the other species of the genus *Chondrostoma* in Iran and the Tigris-Euphrates River drainage by a combination of characters, including lacking a horny blade on the lower jaw, an arched mouth, a short rounded snout, 8 dorsal fin branched rays (9 in the holotype), 10 anal fin branched rays, a lower number of lateral line scales (mean 53.7, range 51-58), a lower number of scales above the lateral line (mean 8.4, range 8-9), a lower number of scales below the lateral line (mean 5.2, range 5-6), short and fewer gill rakers (mean 16.4, range 15-17) along the entire gill arch, and the snout is short and rounded (17.1-20.8 in % of head length versus 25.5% or more). It is also distinguished from other specimens from the Tigris and Euphrates rivers by cytochrome *b* gene characters (Jouladeh-Roudbar, 2014).

Morphology. The body is deep and compressed laterally with a marked nuchal hump. The body is deepest midway between the dorsal fin and the head. The dorsal profile of the head is straight and the dorsal profile of the body is convex. The caudal peduncle is compressed and deep. The mouth is subterminal. Dorsal and anal fin margins are slightly concave. The dorsal fin origin is slightly in advance of, or over, the pelvic fin origin level. The dorsal fin when pushed back does not extend to the level of the anal fin origin. The caudal fin is shallowly forked with rounded lobes. The pectoral and pelvic fins are rounded. The pelvic fins are under the anterior third of dorsal-fin base. The pelvic fins do not reach back to the anus and the pectoral fins do not reach back to the pelvic fins.

Meristic values are:- dorsal fin branched rays 8(10) or 9(1), anal fin branched rays 9(3) or 10(8), pectoral fin branched rays 15-17, and pelvic fin branched rays 8(11). Lateral line scales 51(1), 52(2), 53(3), 54(1), 55(3), 56(-), 57(-) or 58(1), scales above lateral line 8(7) or 9(4), scales below lateral line 5(9) or 6(2), and scales around caudal peduncle 14-16. There is a triangular pelvic axillary scale. Pharyngeal teeth are 6-6. Total gill rakers are 15(3), 16(2) or

17(8). Some populations of *Chondrostoma* in springs or sarabs of Kermanshah Province have relatively low gill raker counts, e.g., the Yavari Spring (18 rakers) (CMNFI 2008-0237) and Sarab Najibaran (20 rakers) (CMNFI 1993-0129) but the snout is long unlike in *C. esmaeilii*. These fish are referred to *C. regium* while recognising further work needs to be done, particularly with molecular characters, to elucidate the status of these spring populations. Total vertebrae number 43.

Sexual dimorphism. Unknown.

Colour. In live fish, the back is olive-brown with greyish tinges and the flanks and belly are silvery-white. The dorsal, anal, pectoral and pelvic fins are orange with a hyaline posterior margin, the caudal fin is bold orange with black posterior margin and sometimes a dark brown base or a thin bar. In some specimens the dorsal fin has a black margin.

Size. Attains 136.4 mm standard length.

Distribution. Sarab-e Ravansar Stream, Kermanshah.

Zoogeography. A taxon currently restricted to a single spring and stream system within the Tigris River basin related to the more widespread *C. regium*.

Habitat. This species inhabits the Sarab-e Ravansar Stream where the current was slow to medium, width was 3-10 m, maximum depth was up to 0.8 m, the bed was muddy and, in some parts, sandy, and there was dense vegetation. The species *Carassius auratus*, *Alburnoides idignensis*, *Oxynoemacheilus kiabii* (Nemacheilidae), and *Gambusia holbrooki* (eastern mosquitofish) were also found in this stream.

Kermanshah, Sarab-e Ravansar Stream, after Eagderi *et al*. (2017).

Age and growth. Eagderi *et al*. (2020) examined 11 fish, 9.7-13.65 cm total length, from the Sarab-e Ravansar and found a *b* value of 3.37, positively allometric.

Food. Unknown but presumably similar to its relative *C. regium*.

Reproduction. None reported.

Parasites and predators. None reported.

Economic importance. None.

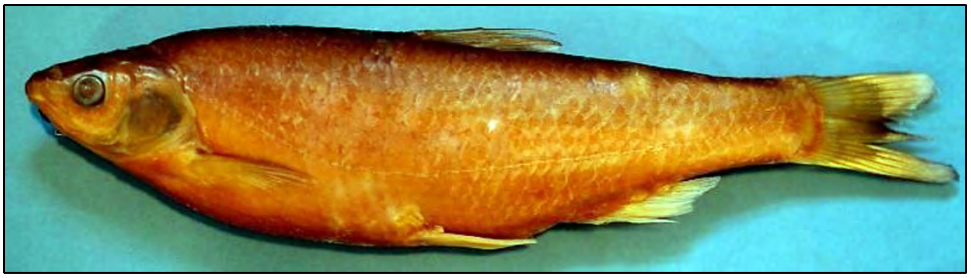
Experimental studies. None.

Conservation. Known only from a single spring and stream locality, this species is susceptible to loss and measures should be taken to conserve it.

Sources. Eagderi *et al*. (2017).

Chondrostoma orientale

Bianco and Banarescu, 1982



Chondrostoma orientale, Fars, Kor River, Hamd Reza Esmaeili.

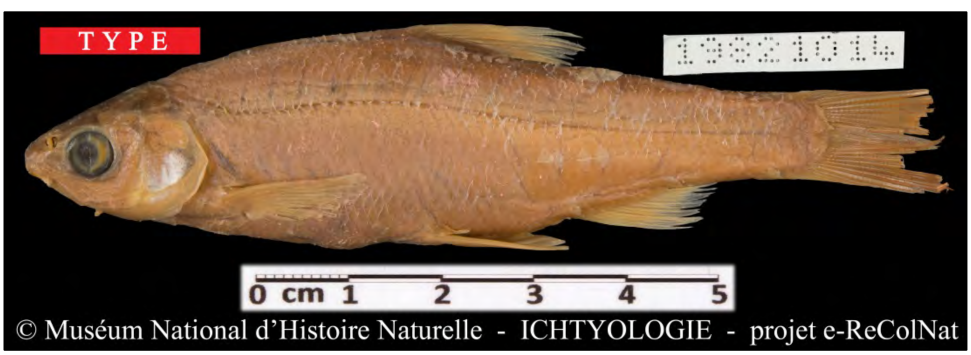
Common names. None.

[Kor nase, Oriental nase].

Systematics. *Chondrostoma cyri orientalis* Bianco and Banarescu, 1982 was originally described from the "Pulwar River near Persepolis". Note that the author name Banarescu is spelled without accents in the type description.

Elvira (1988, 1991, 1997) considered *Chondrostoma orientale* to be a valid species while Nelva *et al*. (1988) retained it as a subspecies of *C. cyri*. Bianco and Banarescu (1982) placed *orientalis* in *C. cyri* on the basis of similar dorsal and anal fin ray counts, scale counts and, to a certain degree, pharyngeal tooth formula.

The holotype (IZA 8170, 93.7 mm standard length, examined by me) and 19 paratypes (IZA 7833, 51 specimens under this number, 35.4-90.1 mm standard length) of *Chondrostoma cyri orientalis* are in the Istituto di Zoologia dell'Universitá di L'Aquila, Italy (Elvira, 1988). Two paratypes of *Chondrostoma cyri orientalis* are stored in the Field Museum of Natural History, Chicago (FMNH 94519) (Ibarra and Stewart, 1987), one paratype is in the Muséum national d'Histoire naturelle, Paris (1982-1014), one paratype is in the United States National Museum, Washington (USNM 227934), two paratypes are in the Academy of Natural Sciences, Philadelphia (ANSP 150985), and six paratypes are in the Canadian Museum of Nature, Ottawa (CMNFI 1982-0365 (cited under the old acronym as NMC 82-365 in the *Catalog of Fishes*, downloaded 15 May 2018), formerly IZA 7833, 37.8-88.7 mm standard length). The total number of paratypes is 75, originally under IZA 7833 but some dispersed as noted above, with 10 further fish in the Institutul de Stiinte Biologice, Bucurešti, Romania (ISBB) but uncatalogued (Bianco and Banarescu, 1982).



Chondrostoma cyri orientalis, paratype, MNHN 1982-1014, L. Randrihasipara (CC BY 4.0).

Chondrostoma cyri orientalis, paratype, CMNFI 1982-0365,
Bronwyn Jackson @ Canadian Museum of Nature.

Key characters. This is the only *Chondrostoma* species in the Kor River basin. Dorsal fin branched rays usually 8 (usually 8-9 in *regium*), anal fin branched rays usually 9 (usually 9-11) and lateral line scales 47-57 (50-69).

Morphology. The body is rounded and moderately deep, being deepest at the dorsal fin origin. A nuchal hump probably develops in large fish. The caudal peduncle is compressed and moderately deep. The predorsal profile is convex. The dorsal head has a straight to slightly rounded profile. The snout is rounded and overlaps the upper lip. The eye lies in the anterior half of the head. The subterminal mouth is a shallow arch with a horny edge and reaches back level with the posterior nostril edge. Lips are of moderate size. The dorsal fin margin is straight to slightly concave. The dorsal fin origin is slightly to obviously anterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back almost to, or to, the beginning of the level of the anal fin origin. The caudal fin is moderately forked with rounded tips, the lower lobe being more rounded. The anal fin is slightly emarginate and does not reach back to the caudal fin base. The pelvic fin is rounded and extends almost to the anus in some fish, more remote in others. The pectoral fin is rounded and does not extend back to the pelvic fin origin.

Dorsal fin unbranched rays 3, branched rays 7-9, usually 8, anal fin unbranched rays 3, branched rays 9-10, pectoral fin branched rays about 16, and pelvic fin branched rays 7-9. Lateral line scales 47-57. Scales are a vertical oval in shape with a rounded posterior margin, short, rounded and wavy dorsal and ventral margins, and a wavy anterior margin with the dorsal and ventral corners pointed. The focus is subcentral anterior and circuli are fine. There are few anterior radii in some with more posterior radii or the anterior and posterior numbers are similar. Total gill rakers number 22-28, 22-30 or 28-32 by different authors (some lower counts may be lower arch rakers only) and see below. Pharyngeal teeth are 6-6. Total vertebrae number 42-45. Moezzi *et al*. (2020) described the osteology of this species and compared it to a European species, *C. nasus*.

Meristic values are:- dorsal fin branched rays 7(1) or 8(30), anal fin branched rays 9(23) or 10(8), pelvic fin branched rays 7(1), 8(29) or 9(1), lateral line scales 49(1), 50(2), 51(3), 52(8), 53(3), 54(7), 55(3), 56(-) or 57(4), scales above lateral line 8(9), 9(19) or 10(3), scales below lateral line 5(22), 6(8) or 7(1), total gill rakers 25(1), 26(-), 27(1), 28(6), 29(6), 30(6), 31(4), 32(1), 33(1) or 34(1), pharyngeal teeth 6-6(19), and total vertebrae 42(5), 43(20), 44(5) or 45(1).

Sexual dimorphism. Unknown.

Colour. Preserved fish have a dark back which becomes lighter ventrally often with the

pigmentation ceasing just below the lateral line. The belly may appear dark from the underlying dark peritoneum. The back may have pre- and postdorsal stripes but these are not always evident. The head is dark dorsally and the underside is immaculate. Pigment is present broadly behind the eye and narrowly below it. Pigment lines the rays of the dorsal, caudal and pectoral fins while the anal and pelvic fins are immaculate or only weakly pigmented.

Size. Attains 17.0 cm total length.

Distribution. This species is found in the Kor River basin including the Kor, Pulvar and Shad Kam rivers, the Ghadamgah Spring-Stream system, and the Kaftar Wetlands (Barzegar and Jalali, 2002; Rahimi and Tabiee, 2013).

Fars, Ghadamgah Stream (Sedeh2, CC BY-SA 4.0, Farsinevisaneiran).

Zoogeography. This species is related to its congener in the Tigris-Euphrates basin and presumably entered and became isolated in the Kor River basin by headwater capture.

Habitat. Recorded from springs, streams and rivers, pools, and even ditches. Collection data included a temperature range of 9.8-20ºC, pH 6.8-7.0, conductivity 0.6-1.0 mS, river width 10-50 m, slow to medium current, depth 1.5 m, clear, cloudy or muddy water, mud, sand, gravel or pebble bottoms, submergent, emergent and floating vegetation including rushes and reeds, and a grassy shore.

Age and growth. Unknown.

Food. Unknown.

Reproduction. None reported.

Parasites and predators. Barzegar and Jalali (2002) reported parasites in this species from Kaftar Lake as *Unio* sp., *Lernaea cyprinacea*, *Ichthyophthirius multifilis* and *Diplostomum spathaceum*. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea cyprinacea* on this species (as *C. regium*). Sayyadzadeh and Joladeh Roudbar (2014) recorded the copepod *Lernaea cyprinacea*, accidentally introduced to Iran with exotic fish species, from this species in the Kor River basin. The presence of pelicans on the Kor River may indicate feeding on this species (see photograph in description of this basin in Volume I).

Economic importance. None.

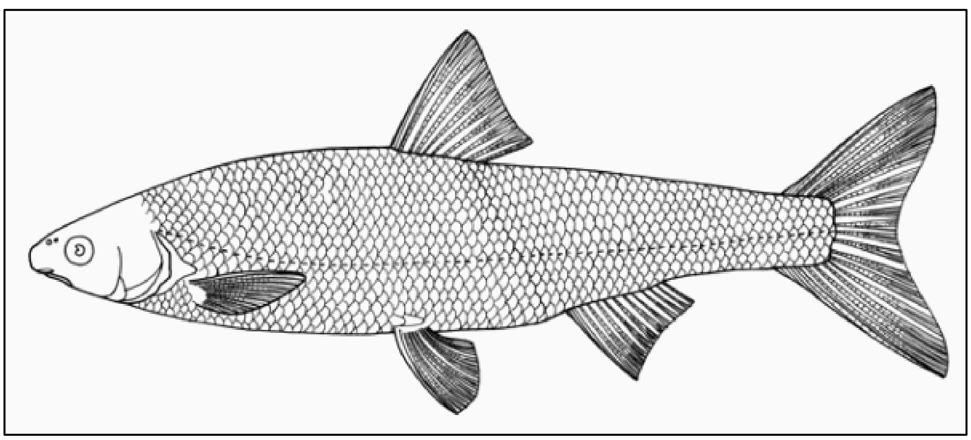
Experimental studies. None.

Conservation. Sayyadzadeh and Joladeh Roudbar (2014) noted that during the past 10 years only three specimens were collected from Kor River basin, in 2005, and it is therefore quite rare. The reasons for this decline are unknown specifically but presumably include drought, water diversions, pollution and similar factors affecting Iranian fishes generally. Simple gear (a small seine net) in shallow water caught this species easily in the 1970s (see below).

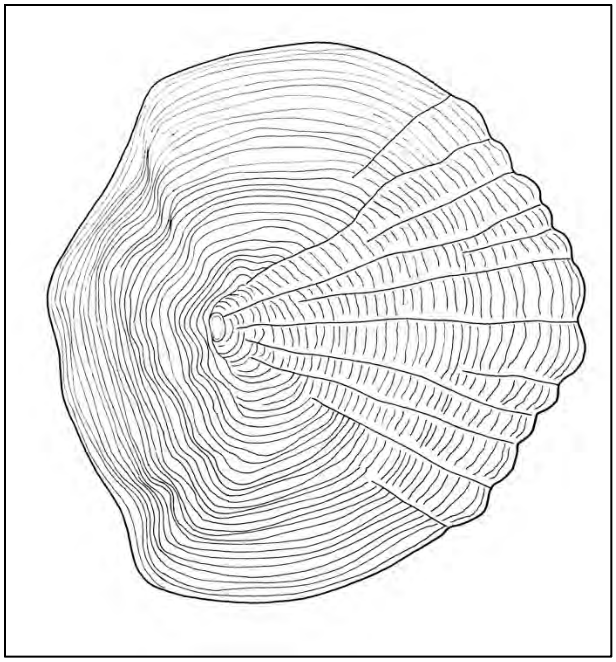
Sources. Type material:- *Chondrostoma cyri orientalis* (CMNFI 1982-0365, IZA 8170 and IZA 7833).

Iranian material:- CMNFI 1979-0025, 16, 22.1-119.0 mm standard length, Fars, Kor River at Marv Dasht (29º51'N, 52º46'30"E); CMNFI 1979-0028, 14, 32.2-139.1 mm standard length, Fars, Zarqan, Kor River drainage (no other locality data); CMNFI 1979-0059, 1, 72.2 mm standard length, Fars, Pulvar River 8 km south of Sivand (30º01'30"N, 52º57'E); CMNFI 1979-0061, 14, 9.5-56.5 mm standard length, Fars, stream tributary to Pulvar River (30º04'N, 53º01'E); CMNFI 1979-0117, 1, 77.8 mm standard length, Fars, Pulvar River at Naqsh-e Rostam (29º59'N, 52º54'E); CMNFI 1979-0499, 1, 113.0 mm standard length, Fars, irrigation ditch 32 km from Kor River bridge (30º04'30"N, 52º36'E); CMNFI 1979-0500, 7, 94.8-110.5 mm standard length, Fars, Pulvar River at Naqsh-e Rostam (29º59'N, 52º54'E); CMNFI 2008-0246, 2, 118.7-133.1 mm standard length, Fars, stream at Sepidan (29º58'19"N, 52º24'04"E).

Chondrostoma regium
(Heckel, 1843)



Chondrostoma regium
Susan Laurie-Bourque @ Canadian Museum of Nature.



Chondrostoma regium, scale,
Freidhelm Krupp.

Chondrostoma regium, Hamadan, Haramabad, Gamasiab River,
January 2010, Keyvan Abbasi.

Chondrostoma regium, Chahar Mahall and Bakhtiari, Gandoman Wetland,
Hamid Reza Esmaeili.

Common names. Jokhorak (= barley eater, possibly barley or barely, Y. Keivany, pers. comm., 25 September 2018), nazak or nazok (= slender), mahi-ye nazok-e jonoub (= southern slender fish), nazi (= cute, Y. Keivany, pers. comm., 25 September 2018); heif-e nan (= waste of bread, i.e., valueless) in Khuzestan; kapur puzeh dar (= longnose carp, Y. Keivany, pers. comm., 25 September 2018), siah deem in Behbehan; siah dom (= blacktail).

[Baloot muluki, pangki; zurri (= the harmful one) at Mosul (also used for *Alburnus sellal*, Oriental killifishes (Aphaniidae), *Gambusia* (Poeciliidae) and any small fishes or large fishes when young); terris or terris achmar meleki (meaning royal red terris) at Aleppo (= Haleb, Syria), all in Arabic; based on Heckel (1843b) for zurri and terris; Kababurun or Kababurun balığı in Turkish and Zul (local name in eastern Turkey) (Çiçek *et al*., 2020; Kaya *et al*., 2016); broad snout, king nase, Mesopotamian nase].

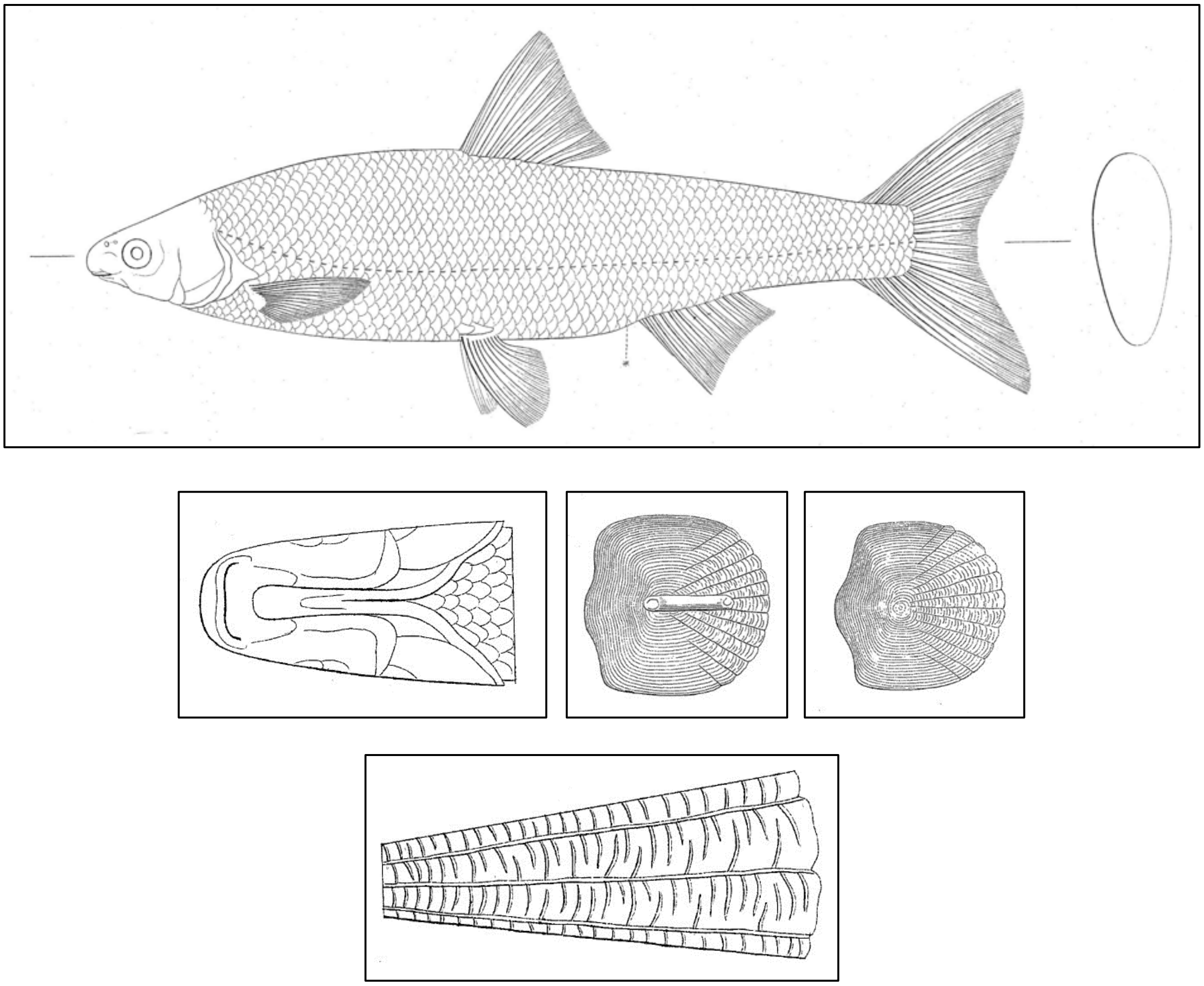
Systematics. *Chondrochilus regius* Heckel, 1843 was described from the ”Orontes” (= Asi) (but see below) and “Tigris”.

Banarescu (1960) regarded *C. regium* as only a race of a widespread species, *C. nasus* (Linnaeus, 1758). *C. nasus* has larger scales on average and 6-6 pharyngeal teeth (Berg, 1949); Heckel (1847c) found 47 *C. nasus* from the Danube River had 6-6 teeth, two had 6-7 and two had 5-6 while in 13 *C. regium* the count was 7-6 in 12 fish and 6-6 in one fish. Krupp (1985c) considered *C. regium* to be distinct while recognising the small degree of morphological variation between species in this genus. Data gathered for Iran show a wide range in scale and teeth counts (see below). Ladiges (1960) identified specimens from the same bodies of water in Turkey as members of both species. The earlier literature on the systematics of this genus remains confused (see Elvira (1988) for comments on Ladiges (1966) and Kuru (1981)). There may well be significant variation of a clinal nature, altitude and temperature may be important, and habitat types (lentic or lotic) may affect body form.

Yousefian *et al*. (2013) were able to separate populations in three headwater streams of the Gamasiab River basin by length and biological parameters using principal components analysis. Jouladeh Roudbar *et al*. (2014a, 2014b) found Iranian Tigris River basin populations could be separated on morphometry, compared to meristics, and attributed the differences to environmental and habitat conditions. Khalaji *et al*. (2015) found a high divergence in morphological characters in the Sefid-barg River, Kermanshah Province. Soghly and Hashemzadeh Segherloo (2015) barcoded fish from four localities in the Karun River basin and one in the Sirvan River basin and found the Karun samples to be monophyletic and distinct from the Sirvan samples.

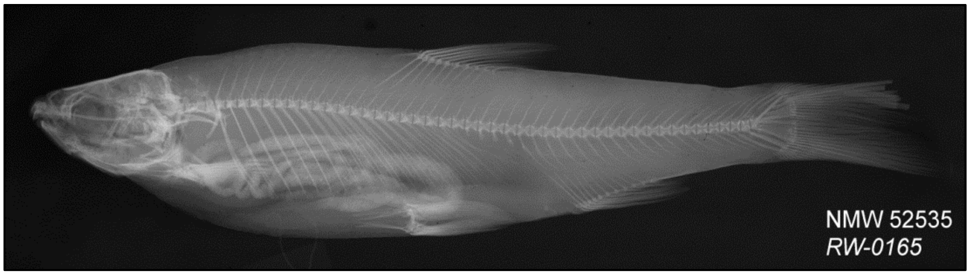
Saadati (1977) referred to an unknown species of *Chondrostoma* from Kermanshah (CMNFI 2007-0113) here identified as *C. regium*.

Twelve syntypes of *Chondrochilus regium* are in the Naturhistorisches Museum Wien (seven fish as NMW 52532-52535 from the Quwayq (= Kueik) River near Aleppo and five fish as NMW 52536-52538 from the Tigris River near Mosul) (Elvira, 1988). Krupp (1985c) gave further details. All material was collected by Th. Kotschy in 1842 from the Quwayq and in 1843 from Mosul and the range in standard length for the fish from the Quwayq is 102-166 mm and from Mosul 119-241 mm. The Vienna catalogue listed only six fish but the card catalogue in 1997 listed NMW 52532 (2 fish), 52533 (2), 52534 (2), 52535 (1), 52536 (2), 52537 (1) and 52538 (2) as syntypes. The type locality “Orontes” (= Asi) in Heckel (1843b) seems to be an error.



Chondrochilus regius,
body and cross-section, ventral head, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Chondrochilus regius, syntype, NMW 52535, Naturhistorisches Museum, Wien.



Chondrochilus regius, syntype, NMW 52535, Naturhistorisches Museum, Wien.

Key characters. This species is found in the Esfahan, Persis and Tigris River basins. Dorsal fin branched rays 8-9 (8 in *orientale*), anal fin branched rays usually 9-11 (usually 9) and lateral line scales 50-73 (47-57).

Morphology. The body is elongate, oval and deepest at the dorsal fin origin. Large fish may develop a nuchal hump. The predorsal profile is convex. The caudal peduncle is compressed and relatively deep. The dorsal head profile is straight to a rounded snout. The snout overlaps the upper lip. The eye is in the anterior half of the head. The mouth is subterminal, has a well-developed keratinised edge and is straight to slightly arched. It extends back level with the nostril. Young fish have a more u-shaped mouth. Lips are moderately thick. The dorsal fin is emarginated in adults, slightly emarginate to rounded in young. The dorsal fin origin is anterior to the level of the pelvic fin origin. The depressed dorsal fin does not extend back as far as the anal fin origin level. The caudal fin is moderately forked with rounded to pointed tips. The anal fin margin is slightly concave to straight and the fin does not extend back to the caudal fin base. The pelvic fin is rounded and does not reach back to the anal opening but reaches the anal papilla. The pectoral fin is rounded and does not reach back to the pelvic fin origin.

Dorsal fin branched rays 8-11, mode 9 (note that Bogutskaya (1997) gave a mode of 10), anal fin branched rays 8-12, mode 11 (note that Bogutskaya (1997) gave modes of 11 or 12), pectoral fin branched rays 14-18, mostly 15-17, and pelvic fin branched rays 6-9, mostly 8. Lateral line scales 50-73, scales above the lateral line 9-13, and scales below the lateral line 5-6. Scale radii are few and restricted to the posterior field. The scale focus is near the anterior scale edge (Küçük *et al*., 2017) but see figure above, and for general shape. Total gill rakers number 17-36 (ranges in single studies, presumably to a consistent technique, are 22-34, 24-31, 25-32, 25-34 and 25-36; but see my counts below). Counts for the whole arch on Iranian fish give a wide range of 18-34, highly correlated with size, larger fish having more (or more discernible) rakers than smaller fish ($r = 0.5049$, $p<0.001$, $n = 90$). Pharyngeal teeth are 5-5, 6-5, 6-6, 6-7, 7-5, 7-6 or 7-7, mode 6-6 or 7-6 but see below for Iranian fish. Total vertebrae number 42-49. A syntype shown above, NMW 52535, has 48 total vertebrae.

Moezi *et al*. (2019) described the osteology of fish from the Jarrahi, Karkheh and Karun rivers.

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(35), 9(46) or 10(1), anal fin branched rays 8(4), 9(45), 10(21), 11(9) or 12(3), and pelvic fin branched rays 7(3), 8(77) or 9(2). Lateral line scales 50(1), 51(5), 52(3), 53(12), 54(5), 55(6), 56(5), 57(4), 58(4), 59(8), 60(7), 61(6), 62(5), 63(3), 64(3), 65(1), 66(2), 67(1), 68(-) or 69(2). Total gill rakers 18(1), 19(2), 20(11), 21(7), 22(10), 23(1), 24(1), 25(3), 26(7), 27(6), 28(3), 29(3), 30(1), 31(4), 32(1) or 33(1). Pharyngeal teeth 5-5(15), 6-5(12), 6-6(13) or 7-6(3). Total vertebrae 42(1), 43(20), 44(17), 45(9), 46(14), 47(10), 48(9) or 49(2). Esmaeili *et al*. (2010) gave a diploid chromosome number of 2n = 52 with 21 pairs of sub-metacentric and five pairs of sub-

telocentric chromosomes from the Fahlian River in Fars. The arm number was 58. Other *Chondrostoma* species have 2n = 50.

Sexual dimorphism. A specimen from CMNFI 2008-0102 with a low gill raker count (ca. 21) but a long snout (see comments above under *C. esmaeilii*) had the following tuberculation. Small tubercles present over entire head including lower surface; dorsally these tubercles are interspersed with larger tubercles. Scales anterodorsally, on the anterior belly and on the caudal peduncle have a tubercle row lining the posterior scale margin and on the anterior exposed scale; belly scales often lack margin tubercles but have them scattered over the scale surface. All fins have tubercles on the rays. These are best developed on the pectoral fin where they form two rows anteriorly, becoming one row on the posterior rays.

Colour. The back is olive-brown with bluish tinges and the flanks and belly are silvery-white. The dorsal and caudal fins are greyish to brownish and the other fins hyaline to brownish. Some fish have bright orange fins, the pectorals paler, the pelvics and anal fins fringed by white. The dorsal and caudal fins have a black margin, wide on the caudal. These fin colours give them a flag-like effect (Heckel, 1843b). The caudal fin can be orange, distally black, with the extreme edge white in freshly dead fish.

Size. Attains 40.0 cm and 1.0 kg.

Distribution. This species is found in the Tigris-Euphrates basin of Turkey, Syria, Iraq and Iran and in the Esfahan and Persis basins of Iran. Mohamed and Abood (2016) reported it for the first time from the Shatt al Arab, Iraq. In Iran it is found in the Esfahan basin in the Dimeh Spring, a tributary of the Zayandeh River, and the Zayandeh River and Dam; in the Persis basin in the Fahlian, Kheyrabad, Tang-e Shiv (Tang-e Shib) and Zohreh rivers; and in the Tigris River basin in the Ab-e Shalamzar (in the Khersan River basin), Ab-e Jahan Bin, Abloun, Agh Bolagh, Alvand, Aran, Armand, Arvand, Bazoft, Beheshtabad, Beshar, Bibi-Sayyedan, Dehno (= Deh Now), Dez, Dinorab, Dinvar, Diyala, Do Ab, Eivashan (= Eushan), Gahar, Gamasiab, Gangir, Garavand, Garus, Haramabad, Harud, Jagiran, Jarrahi, Kaaj, Kahman (as *C. orientalis*), Kahnak, Kalwi, Kangavar Kohneh, Karkheh, Karun, Kashkan, Kharchang, Khersan, Khorram (Khorramabad), Kiar, Kuhrang, Leleh, Mar Bor, Marun, Mehr Gerd, Nahr-e Shavor, Nokhor, Qareh Su, Qodarkabk, Ravansar, Razavar (= Raz Avar), Sarab, Sarab-e Maran, Sefid-barg, Sezar, Shalamzar, Shur, Silakhour, Simareh, Sirvan, Sulgan, Talkhab and Zard rivers, springs (sarabs) near Kermanshah, Sarab Nilofar, Javari Spring near Ravansar, in the Dez and Karkheh dams, the Hawr al Azim, the Choghakor (= Chagha Khur), Gandoman, Hashilan and Khondab wetlands, and the Bisheh-Dalan, Gamasiab, Haramabad and Pir Salman wetlands in Hamadan Province (Wossughi, 1978; Abdoli, 2000; Ghorbani Chafi, 2000; Fadaei Fard *et al*., 2001; Eskandari *et al*., 2007; Sadeghinejade Masouleh, 2008; Abbasi *et al*., 2009; Biokani *et al*., 2011; Kiani *et al*., 2012; Biukani *et al*., 2013; Raissy *et al*., 2013; Dadashi *et al*., 2014; Jouladeh Roudbar *et al*., 2014a, 2015; Mahboobi Soofiani *et al*., 2014; Marammazi *et al*., 2014; Ramin *et al*., 2014; Tabiee *et al*., 2014; Zare *et al*., 2014b; Abdolhahi, 2015; Esmaeili *et al*., 2015; Khalaji *et al*., 2015; Pirshaeb *et al*., 2015; Soghly and Hashemzadeh Segherloo, 2015; Taghavi Niya and Velayatzadeh, 2015; Zamaniannejad *et al*., 2015; Jouladeh-Roudbar *et al*., 2016; Peykanheraty *et al*., 2016; Taghiyan *et al*., 2016; Keivany *et al*., 2017; Mirzergar and Kuilvand, 2017; Pirali Khirabadi *et al*., 2017; Beyraghdar Kashkooli *et al*., 2018; Ebrahimi Dorche *et al*., 2018; Keivany *et al*., 2018a, 2018b; Nasri and Eagderi, 2018; Fatemi *et al*., 2019; Golchin Manshadi *et al*., 2019; Khamees *et al*., 2019; Nasri, 2021).

Zoogeography. See above under the genus.

Habitat. This species is found in rivers, streams, pools, lakes, reservoirs and springs but

habitat requirements have not been studied in Iran in detail. Khalaji *et al*. (2015) noted that it is found at 21-30ºC. Ünlü (2006) reported that this species prefers stone grounds and still waters in rivers and lakes in Turkey. Ghanbary *et al*. (2014) found Gamasiab River fish at 7.5-32ºC. Mohammadi *et al*. (2019) found that higher water temperature and pH are stressful to this species and it lacks the physiological plasticity to cope with global warming and water acidification. Collection data included a temperature range of 14-29ºC, pH 6.0-6.8, conductivity 0.2-1.75 mS, river width 1-75 m (and pool width 300 m), still to fast current, water depth 40-200 cm and deeper, clear and colourless, clear and brown-tinged, cloudy or muddy water, mud, clay, sand, gravel, pebble, stone, boulder or bedrock bottoms, encrusting, submergent such as *Myriophyllum*, emergent such as rushes, and floating vegetation, and a grassy, bushy or forested shore.

Habitat of *Chondrostoma regium* (and type locality of the aphaniid *Esmaeilius vladykovi*), CMNFI 1979-0247, Chahar Mahall and Bakhtiari, pool west of Boldaji (Chagha Khur Lake), 9 June 1977, Brian W. Coad.

Habitat of *Chondrostoma regium* (and *Alburnoides idignensis*, *Alburnus sellal*, *Barbus lacerta*, *Capoeta cf. shajariani* and *Garra rufa* among cyprinoids), CMNFI 2008-0175, Lorestan, Kahman River at Dow Ab-e Aleshtar, 3 December 2000, Brian W. Coad.

Habitat of *Chondrostoma regium*, Chahar Mahall and Bakhtiari, Behestabad River, Yazdan Keivany.

Age and growth. Yousefian *et al*. (2013) found fish up to 6 years old in headwater streams of the Gamasiab River basin. Ghanbary *et al*. (2014) examined 297 fish, 11.7-26.1cm

total length, from the Gamasiab River in the Bisotun region. Age range was 1-5 years, von Bertalanffy growth equations were $L_t = 316[1-e^{-0.25(t+0.577)}]$ in females and $L_t = 306[1-e^{-0.21(t+0.61)}]$ in males, and the length-weight relationship was $W = 8x10^{-6}L^{3.05}$ for males and $W = 6x10^{-5}L^{2.687}$ for females. Abbasi *et al*. (2019) gave a *b* value of 3.03 for 135 fish, 3.3-21.6 cm total length, from the Gamasiab River. Zare *et al*. (2014b) found a *b* value of 2.998 (isometric growth) for 95 fish in the Dez River and a condition factor of 0.69. Khalaji *et al*. (2015) found an age range of 2-4 years in fish from Sefid-barg River, Kermanshah Province. Valikhani *et al*. (2020) combined fish from the Shadegan Wetland and the Dez and Karkheh rivers and reported a *b* value of 2.65 (isometric growth) and a condition factor of 3.05 for 406 fish (3.4-13.5 cm total length).

Mahboobi Soofiani *et al*. (2014) examined a sample numbering 221 fish, 10.5-19.7 cm fork length, from the Dimeh Spring region in the Zayandeh River basin. The maximum age of females was 5 years and males 4 years. von Bertalanffy growth equations were $L_t = 246[1-e^{--0.206(t-0.034)}]$ and $W_t = 163.29[1-e^{-0.206(t-0.034)}]^{2.77}$ for females and $L_t = 253.1[1-e^{--0.206(t-0.175)}]$ and $W_t = 188.25[1-e^{-0.206(t-0.175)}]^{2.99}$ for males. Female:male ratio was 1.8:1. Growth was isometric for males and negative allometric for females. Weights and lengths were less than other populations, perhaps due to age structure, ecology or fishing gear used. Lake populations may attain a larger size than this riverine one. Beyraghdar Kashkooli *et al*. (2018) assessed age and growth for 63 fish from the upper Zayandeh River and found four age groups of 2 to 5 years with most fish aged 3 to 4 years, a length-weight relationship of $W = 0.009SL^{3.21}$, the most reliable von Bertalanffy growth model was scale-based (as opposed to otolith- and vertebra-based) and was $L_t = 303\ (1-e^{-0.11(t-(-0.34))})$. Beyraghdar Kashkooli *et al*. (2019) demonstrated the relationship between otolith weight and age in Zayandeh River fish.

Keivany *et al*. (2015) gave a *b* value of 3.1 (positive allometric growth) for 335 fish, 3.32-23.1 cm total length, from the Behesthabad River, in the Karun River basin. Keivany *et al*. (2018a, 2018b) also examined these 335 fish from the Beheshtabad River and found males to be 8.04-22.1 cm and 5.2-105.0 g, females were 7.84-23.15 cm and 8.7-155.0 g, males were in age classes 1^+-5^+ and females 1^+-6^+ with age class 3^+ dominant, the male:female sex ratio was 1:1.3 and was significantly different with females dominating in all age groups, the length-weight relationship for males, females and all individuals was as $W = 0.0089L^{3.045}$, $W = 0.0082L^{3.109}$ and $W = 0.0107L^{3.0}$ respectively, indicating positive allometric growth pattern for the females and isometric growth for the males and all fish combined, the age-length and age-weight relationships in males and females were estimated as $L_t = 26.23[1-e^{-0.267(t+0.483)}]$, $W_t = 160.77[1-e^{-0.267(t+0.483)}]^{3.045}$ and $L_t = 31.89[1-e^{-0.148(t+2.067)}]$, $W_t = 266.11[1-e^{-0.148(t+2.067)}]^{3.109}$, respectively, the growth performance index (Φ') value was 3.84 in males and 2.18 in females, indicating a faster growth rate in males, and the mean condition factor was 1.02 for males and 1.14 for females and higher in spring than in fall.

Keivany *et al*. (2016) gave a *b* value for 335 fish, 5.95-23.15 cm total length, from the Bibi-Sayyedan River, Semirom of 3.0864. Kiani *et al*. (2016) examined 471 fish, 5.5-21.5 cm total length, from the Bibi-Sayyedan River and found a length-weight relationship of $W = 0.007L^{3.088}$ for males, $W = 0.007L^{3.086}$ for females and $W = 0.007L^{3.079}$ for all fish, indicating positive allometric growth. Males were smaller than females perhaps due to halting of growth at maturity and higher male mortality. Age range was 1^+ to 4^+ years in males and 1^+ to 5^+ in females with some 0^+ fish undetermined as to sex. The 3^+ year class dominated in both sexes. The sex ratio was 1:2.3 with females dominant in all age groups and capture months. von Bertalanffy growth equations for length were $L_t = 18.97[1-e^{-0.279(t+0.58)}]$ in males and $L_t = 23.85[1-e^{-0.196(t+0.535)}]$ in females and for weight were $W_t = 61.91[1-e^{-0.279(t+0.58)}]$ in males and $L_t =$

$124.75[1-e^{-0.196(t+0.535)}]$ in females. Growth parameters were $L_\infty = 18.97$ cm, $t_0 = -0.58$ year, $K = 0.279$ year^{-1} and $\Phi' = 2.35$ in males and $L_\infty = 23.87$ cm, $t_0 = -0.535$ year, $K = 0.196$ year^{-1} and $\Phi' = 2.23$ in females. Males showed a higher growth rate than females. Fish from the Bibi-Sayyedan River showed relatively slower growth than other populations.

Khalaf *et al*. (1986) studied 255 specimens of this species in the Diyala River, Iraq. Maximum age group was 7^+ years, males and females showed no difference in weight at the same length and samples from three adjacent areas showed no major differences in growth rates. Length-weight relationship was $W = 0.0480L^{2.49}$. Males matured at 15.0 cm and females at 19.0 cm in the Diyala River at Rustamiyah in Iraq (Allouse *et al*., 1986). A population at Al Kadhmia north of Baghdad in the Tigris River had four age classes dominated by the 3-year age class, with all fish being sexually mature during the second year. Fish smaller than 15 cm for males and 17 cm for females were immature. The disparity in age structure with the Diyala River population was attributed to pollution in the Diyala (Daoud and Qasim, 1999). Jasim and Ahmed (2009) recorded this species as dominant in the catch at Mosul, Iraq.

Polat and Gümüş (1995) aged a population of this species in the Bafra Altınkaya Dam in Turkey using vertebrae, otoliths, scales, opercles and subopercles. Age reached 5, perhaps 6, years. Polat *et al*. (1999) found a similar age range in the Suat Uğurlu Dam, Turkey with annulus (hyaline ring) formation in October to February. Oymak (2000) examined growth characteristics of this species in the Atatürk Dam on the Turkish Euphrates River. Eight age groups were found and age-length and age-weight equations given for females and males were $L_t = 38.67[1-e^{-0.136126(t+3.073799)}]$, $W_t = 527.52[1-e^{-0.136126(t+3.073799)}]^{3.1986}$ and $L_t = 35.01[1-e^{-0.168137(t+2.754214)}]$, $W_t = 724.73[1-e^{-0.168137(t+2.754214)}]^{3.2779}$ respectively. The length-weight relationships were obtained as Log W = -5.4153 + 3.1986 Log FL in females and Log W = -5.6212 + 3.2779 Log FL in males. The condition factor was high in age group 7 and high in April and May, lowest in December and January. Gümüş *et al*. (2002) found deposition of hyaline rings was synchronous with decrease in food diversity in autumn in the Suat Uğurlu Dam, Turkey. Aydin *et al*. (2004) demonstrated a positive linear relationship between otolith length and fish length for this species in Keban Dam, Turkey. Serdar and Özcan (2018) examined 232 fish from 14 stations in the Qarasu River in eastern Anatolia, Turkey and found a *b* value of 2.77 (negative allometric growth) and a condition factor of 1.102.

Food. This species is omnivorous taking insect larvae, worms, eggs and fry of other fishes and algae in headwater streams of the Gamasiab River drainage (Yousefian *et al*., 2013). Gut contents also included diatoms as well as large quantities of sand. However, Gümüş *et al*. (2002) examined diet in the Suat Uğurlu Dam, Turkey and found *Navicula*, *Cymbella* and *Synedra* were the most frequently consumed organisms. This species fed mostly on Bacillariophyta in this dam but also Chlorophyta, Cyanophyta, Xanthophyta, Euglenophyta and Rotifera. Diet varied with seasonable availability of food items. Keivany *et al*. (2018a) examined 335 fish from the Beheshtabad River and found the relative length of gut was 1.18 for all fish, indicating an herbivorous habit. The highest mean feeding intensity of males was in July and the lowest in March and April. In the female, the highest was in January and the lowest in June. The highest mean value of gut vacuity index of males and females was in the spring and the lowest in summer. About 55% of the studied stomachs were full. The highest number of empty stomachs was in May (80%) and the lowest in July (32%). Based on the mean gut vacuity index (48%), this fish is considered a medium feeding fish.

Reproduction. The Dimeh Spring population examined by Mahboobi Soofiani *et al*. (2014) matured in the second year of life with spawning during May and June. Mean absolute

and relative fecundity was 2,429 eggs and 78.1 eggs/g. Fish in the Bibi-Sayyedan River of the upper Tigris River basin near Semirom had a peak gonadosomatic index in March, declining sharply afterwards, indicating a short spring spawning period. Egg diameters reached 1.7 mm (Kiani *et al*., 2012). Kiani *et al*. (2021) also examined fish from the Bibi-Sayyedan River and found a sex ratio of 1male:2.3females, age groups of the males and females were 1-4 and 1-5 years, the maximum total length and weight of males were 18.1 cm and 65 g and of females were 22.0 cm and 91 g. The minimum and maximum absolute fecundity were 600 and 6,500 eggs, the average egg diameter was 0.65 mm, the minimum and maximum egg diameters were 0.27 and 1.7 mm. The mean gonadosomatic index was 1.53 in males and 4.37 in females. This index showed significant differences in different months in both males and females and the maximum value in females was observed in March and was significantly different from that of other months. Based on gonadosomatic index values, egg diameter and histological studies, this species had a short spawning period during late March to early April. The ovary in this species is group synchronous. Fish examined by Ghanbary *et al*. (2014) in the Gamasiab River had mean gonadosomatic indices in females of 9.15 and in males 1.5, mean absolute fecundity was 9,440.98 eggs, and mean egg diameter was 1.05 mm (range 0.54-2.0 mm). Maximum condition factors were in April for males and March for females. The reproduction season was March to May. Keivany *et al*. (2018b) examined 335 fish from the Beheshtabad River and found a significant increase in oocyte diameter from April to June with a decrease in July and August corresponding to the gonadosomatic index. The highest gonadosomatic index for males was in April and for females in June. The spawning season was from late March to June.

Studies on the Diyala River population in Iraq found fish to be mature in December and by January females lacked eggs. Each female produced up to 6,900 eggs and number of eggs increased linearly with length (Allouse *et al*., 1986). The breeding season at Al Kadhmia in the Tigris River near Baghdad was March-May (Daoud and Qasim, 1999). Al-Rudainy (2008) gave sexual maturity as 3 years, 25 cm total length and 250 g weight with spawning in February and March on gravel beds in shallow water with strong current for Iraq. Ünlü (2006) reported up to 13,280 eggs for fish in the Tigris River of Turkey. Beckman (1962) stated that this species probably spawns in May or June in Syria and Oymak (2000) found that condition factors were highest in April and May in the Atatürk Dam, Turkey.

Parasites and predators. Barzegar *et al*. (2004) examined this species for parasites in fish from the Beheshtabad River in Chahar Mahall and Bakhtiari Province and found *Lernaea cyprinacea*, *Dactylogyrus ergensi*, *Ichthyophthirius multifilis* and *Myxobolus* sp. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G*. sp. from the Dez and Karun rivers in *Chondrostoma nasus*, presumably this species. Barzegar *et al*. (2008) recorded the digenean eye parasites *Diplostomum spathaceum* and *Tylodelphys clavata* from this fish. Raissy *et al*. (2009) found the digenean eye parasite *Tylodelphys clavata* in fish from Choghakhor (= Chagha Khur) Lagoon. Raissy *et al*. (2013) recorded parasites from fish in the Kaaj River, an upper Karun River tributary, namely *Ichthyophthirius multifilis* (Ciliophora) and *Rhabdochona* sp. (Nematoda). Keivany *et al*. (2017) examined 26 fish from the Beheshtabad River and found *Ichthyophthirius multifilis*, *Philometra* sp. and *Trichodina* sp. Moumeni *et al*. (2020) recorded the zoonotic *Philometra* sp. from this species in Iran.

Economic importance. This species has been caught and used for food in Khuzestan and Kermanshah (Khalaji *et al*., 2015). It sold for 100 rials/kg in 1978.

Experimental studies. Pirshaeb *et al*. (2015) found high levels of chromium and vanadium, exceeding international standards, in muscle tissue of fish from the Gharasou (=

Qareh Su) in Kermanshah from industrial and municipal wastewater. Peykanheraty *et al*. (2016) examined the histopathological effects of cadmium chloride on fish from a branch of the Zayandeh River, finding hyperplasia, clubbing and fusion of gills, and congestion, nuclear psychosis and necropsis of the liver, and intensity dependent on dose. Ghanbary *et al*. (2013) related total, fork and standard length to weight in male fish, useful in selecting fish with better total weight traits in breeding programmes. Mahboobi Soofiani *et al*. (2015) showed that higher temperatures led to an increase in maximum metabolic rate and aerobic scope whereas low temperatures led to a decrease. Mohammadi *et al*. (2018) found that an increase in water temperature (28-31ºC) acted as a loading stressor while a decrease in temperature (3.5-6.5ºC) acted as a limiting stressor.

Conservation. This species is relatively common and is not widely used as food; it may not need conservation. However, it is listed as endangered in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Iranian material:- CMNFI 1979-0245, 5, 35.3-47.1 mm standard length, Chahar Mahall and Bakhtiari, stream in Ab-e Shalamzar drainage (Khersan River basin) (32º08'N, 50º51'E); CMNFI 1979-0246, 4,55.9-64.2 mm standard length, Chahar Mahall and Bakhtiari, stream 8 km west of Boldaji (31º57'30''N, 50º59'E); CMNFI 1979-0247A, 4, 57.2-65.3 mm standard length, Chahar Mahall and Bakhtiari, pool 3 km west of Boldaji (31º57'N, 51º01'E); CMNFI 1979-0248A, 2, 39.2-65.2 mm standard length, Chahar Mahall and Bakhtiari, stream 3 km east of Boldaji (31º55'N, 51º05'E); CMNFI 1979-0271, 11, 60.0-131.3 mm standard length, Lorestan, river in Kashkan River drainage (33º39'N, 48º32'30''E); CMNFI 1979-0272, 1, 58.5 mm standard length, Lorestan, river at Nokhor (ca. 33º40-47'N, ca. 48º28-45'E); CMNFI 1979-0273, 1, 59.5 mm standard length, Lorestan, Kashkan River drainage 5 km from Khorramabad (33º26'N, 48º19'E); CMNFI 1979-0275, 5, 31.4-42.4 mm standard length, Lorestan, Kashkan River 2 km from Ma'mulan (33º25'N, 47º58'E); CMNFI 1979-0279, 2, 61.8-134.0 mm standard length, Lorestan, Khorramabad River (33º37'N, 48º18'E); CMNFI 1979-0280, 1, 114.5 mm standard length, Lorestan, Kashkan River drainage (ca. 33º43-47'N, 48º12-15'E); CMNFI 1979-0283, 1, 137.0 mm standard length, Kermanshah, river in Qareh Su drainage (34º21'N, 47º07'E); CMNFI 1979-0286, 11, 77.4-100.4 mm standard length, Kermanshah, Ravansar River at Ravansar (34º43'N, 46º40'E); CMNFI 1979-0287, 22, 56.6-112.5 mm standard length, Kermanshah, Cheshmeh Javari 2 km from Ravansar (ca. 34º42'N, ca. 46º40'E); CMNFI 1979-0289, 1, 131.5 mm standard length, Kermanshah, river in Diyala River drainage (34º28'N, 45º52'E); CMNFI 1979-0368, 4, 54.0-84.5 mm standard length, Khuzestan, Karkheh River (32º24'30''N, 48º09'E); CMNFI 1979-0370, 6, 187.3-221.6 mm standard length, Khuzestan, Karkheh River (32º12'N, 48º14'30''E); CMNFI 1979-0382, 2, 37.7-62.5 mm standard length, Khuzestan, Karun River at Shushtar (32º03'N, 48º51'E); CMNFI 1979-0392, 1, 53.7 mm standard length, Khuzestan, Zard River (ca. 31º32'N, ca. 49º48'E); CMNFI 1979-0396, 2, 39.0-42.7 mm standard length, Khuzestan, Kheyrabad River 20 km from Behbehan (30º32'N, 50º23'30''E); CMNFI 1979-0421, 5, 114.0-122.0 mm standard length, Kohgiluyeh and Bowyer Ahmad, stream in Khersan River drainage (30º24'N, 51º47'E); CMNFI 1991-0154, 1, 264.3 standard length, Khuzestan, Hawr al Azim (ca. 31º45'N, ca. 47º55'E); CMNFI 1993-0127, 1, 141.4 mm standard length, Kermanshah, Sarab-e Maran (34º44'N, 46º51'E); CMNFI 1993-0129, 1, 146.8 mm standard length, Kermanshah, Sarab Najibaran (34º00-30'N, 47º00-30'E); CMNFI 1993-0149, 1, 194.3 mm standard length, Khuzestan, Karun River (no other locality data); CMNFI 2007-0100, 2, 165.4-165.7 mm standard length, West Azarbayjan, Kalwi Chay near Piranshahr (ca. 36º44'N, ca. 45º10'E); CMNFI 2007-0111, 2, 183.3-191.7 mm standard length,

Kermanshah, Alvand River near Sar-e Pol-e Zahab (ca. 34º36'N, ca. 45º56'E); CMNFI 2007-0113, 2, 106.7-145.0 mm standard length, Kermanshah, Razavar (= Raz Avar) River, Qareh Su tributary (ca. 34º25'N, ca. 47º01'E); CMNFI 2007-0115, 3, 72.5-96.5 mm standard length, Kermanshah, Qareh Su basin north of Kermanshah (ca, 34º34'N, ca. 46º47'E); CMNFI 2007-0119, 17, 31.7-50.8 mm standard length, Kermanshah, Gamasiab River near Kangavar (ca. 34º31'N, ca. 48º03'E); CMNFI 2008-0102, 3, 166.8-185.6 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data); CMNFI 2008-0102, 2, 117.1-124.8 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data) (the prior two collections with the same catalogue number are separated here as they differ in certain characters (e.g., gill raker counts) and are probably from separate sarabs); CMNFI 2008-0132, 1, 189.4 mm standard length, Khuzestan, neighbourhood of Ahvaz (no other locality data); CMNFI 2008-0151, 1, 173.3 mm standard length, Kermanshah, Gamasiab River (34º10'44"N, 47º20'48"E); CMNFI 2008-0175, not kept, Lorestan, Kahman River at Dow Ab-e Aleshtar (33º47'N, 48º12'E); CMNFI 2008-0182, 1, 111.7 mm standard length, Chahar Mahall and Bakhtiari, Ab-e Bazoft Sofla (31º38'06"N, 50º28'30"E); CMNFI 2008-0184, 2, 81.2-82.2 mm standard length, Chahar Mahall and Bakhtiari, Armand River (31º37'N, 50º47'E); CMNFI 2008-0185, 2, 90.2-93.2 mm standard length, Chahar Mahall and Bakhtiari, Sulgan River (31º30'N, 50º50'E); CMNFI 2008-0191, 1, 64.6 mm standard length, Chahar Mahall and Bakhtiari, Ab-e Bazoft (31º38'06"N, 50º28'30"E); CMNFI 2008-0236, 1, 115.2 mm standard length, Kermanshah, Mereg River (35º25'N, 46º17'E); CMNFI 2008-0237, 1, 83.4 mm standard length, Kermanshah, Yavari Spring (34º28'N, 46º56'E); CMNFI 2008-0238, 1, 171.3 mm standard length, Kermanshah, Qareh Su (33º56'42"N, 47º28'40"E).

Comparative material:- BM(NH) 1931.8.12:1-3, 2, 136.0-172.2 mm standard length, Iraq, near Mosul (36º20'N, 43º08'E); BM(NH) 1971.4.2:6, 1, 147.7 mm standard length, Iraq, River Tigris near Mosul (36º20'N, 43º08'E); BM(NH) 1974.2.22:81-82, 1, 197.5 mm standard length, Iraq, Great Zab near Eski Kelek and near Bekhne Dam (no other locality data).

Genus *Leucaspius*

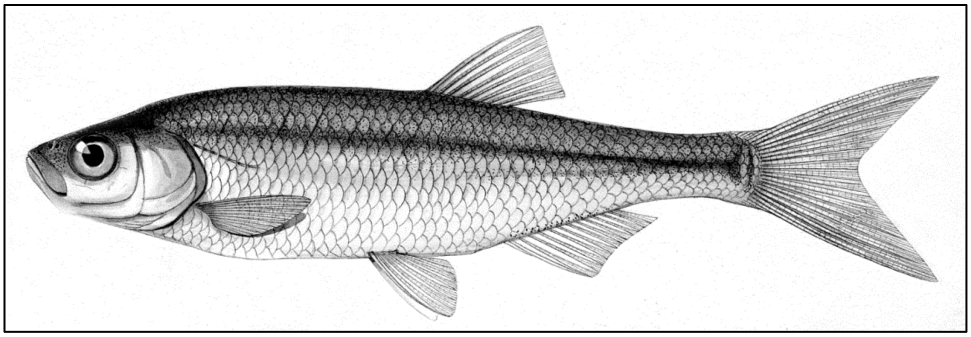
Heckel and Kner, 1857

The genus *Leucaspius* has a single species with a wide distribution in Europe and is also found in Iran. Schönhuth *et al*. (2018) noted that it was included in the *Alburnus* clade in their molecular analysis and the *Alburnus-Leucaspius* clade was the sister group to *Scardinius*.

The genus is characterised by a moderately compressed and elongate body, an incomplete lateral line on up to about 13 scales, moderately large, easily detached scales, short dorsal and somewhat longer anal fin, belly without a keel but somewhat compressed, terminal mouth with lower jaw entering the depression of the upper, pharyngeal teeth usually in two rows but counts variable, and gill rakers of moderate size and density.

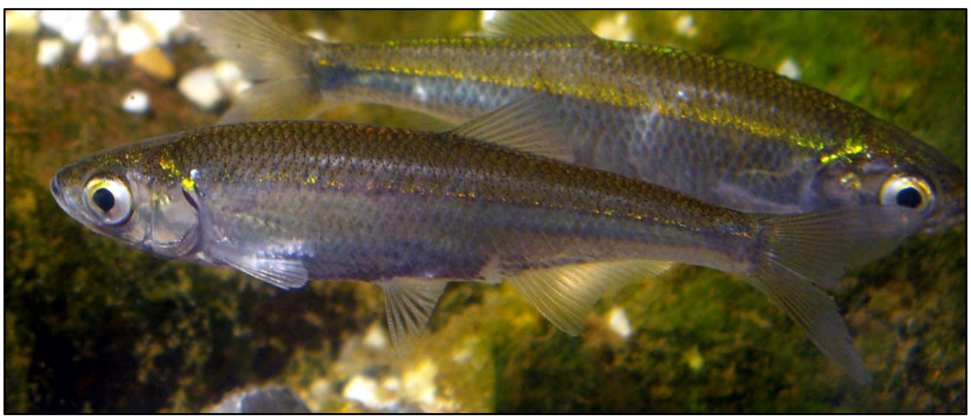
Leucaspius delineatus

(Heckel, 1843)



Leucaspius delineatus, 8.5 cm total length, Russia, Lake Chukhloma in the basin of the Kostroma River, after Berg (1948-1949).

Leucaspius delineatus, Gilan, Anzali Wetland, November 2009, Keyvan Abbasi.



*Leucaspius delineatus***,** Hoensbroek, The Netherlands (Alburnus alburnus cropped, CC BY-SA 3.0, Viridiflavus).

Common names. Mahi-ye riz-e noqrei or mahi-e-rize-noghreie (= small silvery fish).

[Gafgaz ustuzani in Azerbaijan; Kavkazskaya verkhovka or Caucasian verkhovka, ovsyanka, verkhovka in Russian; rain bleak, sunbleak, white aspe; belica; Moderlieschen in German].

Systematics. *Squalius delineatus* was originally described from Wien and Mähren, Austria. The Caspian Sea basin taxon was given by Berg (1948-1949) as *Leucaspius delineatus delineatus* natio *caucasicus* Berg, 1949, described from Transcaucasia, which is distinguished by a lower average dorsal fin branched ray count (7-8 rather than 8 or rarely 9 for the typical form of Europe). This natio has been applied as a subspecies by some authors (Arnold and Längert, 1995).

Key characters. The large, rounded papillae around the genital opening are distinctive in females, and for both sexes the combination of an incomplete lateral line with moderately large scales is key.

Morphology. The body is compressed and elongate, being deepest at the level of the pelvic fins. The predorsal profile is straight to slightly convex, with an incision at the head and body border, and falling slightly to the mouth tip. The caudal peduncle is compressed and shallow to moderate in depth. The belly is compressed in the mid-line between the pelvic fins and the vent but does not form a strong keel. The snout is pointed. The mouth is very oblique and superior. Lips are thin. The dorsal fin margin is straight to slightly emarginate. The dorsal fin origin is markedly posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back to the level of the mid-anal fin. The caudal fin is moderately forked with rounded or pointed lobes. The anal fin is emarginate and when depressed does not reach back to the caudal fin base. The pelvic fin is rounded and extends back to the anus and falls short of the anal fin origin. The pectoral fin is rounded and extends back almost to the pelvic fin origin or falls well short.

Dorsal fin with 2-3, usually 3, unbranched rays followed by 7-10 branched rays (usually 8 in Europe but counts of 7 and 8 are about equally frequent in the Caucasian populations according to Berg (1948-1949) but Abdurakhmanov (1962) gave a frequency of 94% for 8 rays and only 6% for 7 rays in fish from Azerbaijan), anal fin with 3-4, usually 3, unbranched rays followed by 9-17 branched rays (10-12 in the Caucasian “subspecies”), pectoral fin branched rays 11-16, and pelvic fin branched rays 7-8. Scales are caducous. Lateral series scales 36-53, lateral line incomplete with 0-13 pored scales anteriorly. Scales bear few anterior and posterior radii, have few circuli, a subcentral anterior focus and are a vertical oval in shape. Total gill rakers number 10-17 (rarely 20, usually 13-16), reaching the second raker below when appressed. Pharyngeal teeth are very variable and counts are 5-5, 5-4, 4-4, 4-5, 1,5-5, 5-5,1, 1,5-4, 5-4,1, 1,4-4, 4-4,1, 1,5-5,1, 1,5-5,2, 1,4-4,1, 1,4-5,1, 1,5-4,1, 1,5-4,2, 1,4-5,2, 2,5-4,1, 2,5-4,2, 2,5-5,2 and even 2,5-6,1. The frequency of various counts varies with locality, and even whether single row counts dominate over two-rowed counts (Arnold and Längert, 1995). Teeth are hooked at the tip and slightly to strongly serrated. The gut is an elongate s-shape. Total vertebrae number 36-40. The chromosome number is 2n = 50 (Klinkhardt *et al*., 1995; Arai, 2011).

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(10) or 9(1), anal fin branched rays 10(4) or 11(7), pectoral fin branched rays 11(7), 12(3) or 13(1), pelvic fin branched rays 7(10) or 8(1), scales in lateral series 39(3), 40(5), 41(1), 43(1) or 45(1), total gill rakers 13 (4) or 14(7), and total vertebrae 36(1) or 37(9). One specimen showed fusions of abdominal vertebrae.

Sexual dimorphism. Females have a unique fold of skin in the shape of two, large, rounded papillae around the genital opening. The male is a little smaller than the female. Males develop prominent nuptial tubercles on the dorsal head surface, snout, on the lower jaw in three pairs and on the upper jaw in two pairs for a total of about 60 tubercles. Small tubercles line the rays of the anal, pectoral and pelvic fins with very few on the dorsal fin. The male genital opening is depressed.

Colour. The back is olive-green to brown and the flanks and belly silvery-white, or quite dark brown. A steel blue, silvery blue or bluish-green stripe begins at the rear third of the body and extends back, broadening, to the tail base. Fins are hyaline or slightly yellowish. The anal fin can be distally whitish and proximally as dark as the adjacent body. The peritoneum is light.

Size. Attains 12.0 cm total length although only up to 5.6 cm total length in the Caucasian form.

Distribution. This species is found in western and central Europe from the Rhine and north of the Alps east to northern drainages of the Black Sea and the western and northern drainages of the Caspian Sea. *Leucaspius delineatus caucasicus* is found in the north Caucasus including the Black Sea parts and in Transcaucasia. In the southern Caspian Sea basin, it is found in the lower reaches of the Kura River, Imeni Kirova Bay and the Lenkoran region of Azerbaijan (Kuliev, 1989). A single specimen from Iran was collected by Akbar Nasrollazadeh near Siah Darvishan (which is at 37°22'N, 49°26'E) in Gilan on 27 May 1993. In June 1996 over 50 specimens were caught in the Anzali Talab by K. Abbasi and A. Sarpanah of the Gilan Fisheries Research Centre (*Iranian Fisheries Research and Training Organization Newsletter*, 15:4, 1997). Also reported from the Anzali Talab by Abbasi *et al*. (1999, 2017) and present in the Pir Bazar, Pesikhan and Sefid rivers, Hendeh Khaleh swamp and the Amirkelayeh Wetland (Nasrollazadeh, 1999; K. Abbasi, pers. comm., 2001; Eagderi *et al*., 2020).

Zoogeography. The Caspian shore of Iran has been surveyed in some detail during the 20th century and it is curious that this species was only discovered towards its end. It may simply have been confused with other small, silvery minnows although it should be noted that some of the surveys were carried out by Russian workers familiar with this species. It may be a recent introduction with other, commercial exotics, and therefore may not be from a Caucasian population.

Habitat. This species is found in rivers, streams, lakes, ponds, dams, lagoons and marshes, usually in still or slowly flowing water with vegetated shores in large schools. It can be found in fish ponds, ditches, gravel pits and quarries as well as natural habitats. Still water is required for reproduction. It is tolerant of a wide range of temperatures, pH and salinity depending on adaptation, e.g., temperature range of 3-32.8°C (Arnold and Längert, 1995). This small fish is found in large schools near the water surface. It may appear in small ponds without any apparent connection to other water bodies, hence the German name that has been interpreted as “Moderlieschen” or motherless. However, the German name may more correctly mean mud lover (G. H. Copp, *in litt*., 16 June 2004).

Age and growth. Life span is about 4-6 years with growth fairly continuous over this period. Eagderi *et al*. (2020) examined 17 fish, 6.03-8.75 cm total length, from the Sefid River and found a *b* value of 3.35, positively allometric.

Food. Diet comprises plankton such as cladocerans, copepods and rotifers, benthic chironomids, flying insects which land on the water surface, and also some algae and detritus.

Reproduction. There is often a spawning migration against the water flow (up to 2-3 m/sec) to new waters. Eggs are laid in strings which are wound spirally around plants by the female, aided by the fold of skin around the genital opening. They may also be laid in a disc-shaped patch on any flat surface. Several spawnings occur over a few weeks in March to September in Europe. The eggs are guarded and fanned by the male who covers them with bacteriostatic dermal mucus. Up to 485 eggs are found in females and have diameters up to 0.5 mm in Azerbaijan, up to 3,500 eggs and 1.5 mm in Europe. Maximum egg production over two seasons is about 500-600 (Abdurakhmanov, 1962). Clutch sizes are about 50-350 eggs (Arnold and Längert, 1995). A minimum temperature of 18°C is required for reproduction.

Parasites and predators. Mirhashemi Nasab *et al*. (2017) found *Diplostomum spathaceum* in fish from the Anzali Wetland with prevalence (20.0%) and range (1-5 worms in a fish).

This fish is eaten by a wide variety of other fishes in Europe and numerous parasites are reported (Arnold and Längert, 1995).

Economic importance. The scales have been used in the production of artificial pearls as with *Alburnus alburnus* (a relative of *A. hohenackeri*). The abundant population in Lake Chukhloma, Russia was fished commercially (Berg, 1948-1949). It has also been used in aquaria and garden ponds and as bait by anglers.

Experimental studies. None.

Conservation. Lelek (1987) classified this species as rare to vulnerable in Europe. Kiabi *et al*. (1999) considered this species to be conservation dependent in the south Caspian Sea basin according to IUCN criteria. Criteria included few in numbers, habitat destruction, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Arnold and Längert (1995) summarised biology of European populations in detail.

Iranian material:- CMNFI 2008-0112, 1, 34.6 mm standard length, Gilan, swamp near Hendeh Khaleh (37º23'N, 49º28'E); CMNFI 2008-0239, 10, 31.2-37.5 mm standard length, Gilan, Anzali Talab (ca. 37°26'N, ca. 49°25'E).

Genus *Leuciscus*
Cuvier, 1816

The genus *Leuciscus s.l.* is not monophyletic based on allozyme data for a limited number of European taxa (Hänfling and Brandl, 2000). There may be about 17 species in the genus with two species reported from Iran. Many species formerly in this genus are now placed in *Squalius* Bonaparte, 1837.

The genus *Aspius* Agassiz, 1832, the asps, comprised two species found in Europe and Southwest Asia. Recent molecular studies by Perea *et al*. (2010) and Schönhuth *et al*. (2018) showed the two *Aspius* species are not clustered together and fall in *Leuciscus*. Much literature will, of course, be found under the earlier genus name. Pourshabanan *et al*. (2021) used two mitochondrial (CYTB and COX1) and one nuclear (RAG1) genomic markers in order to assess the taxonomic relationships between two Iranian species and confirmed their presence as distinct species with an interspecific genetic distance of 10.6%.

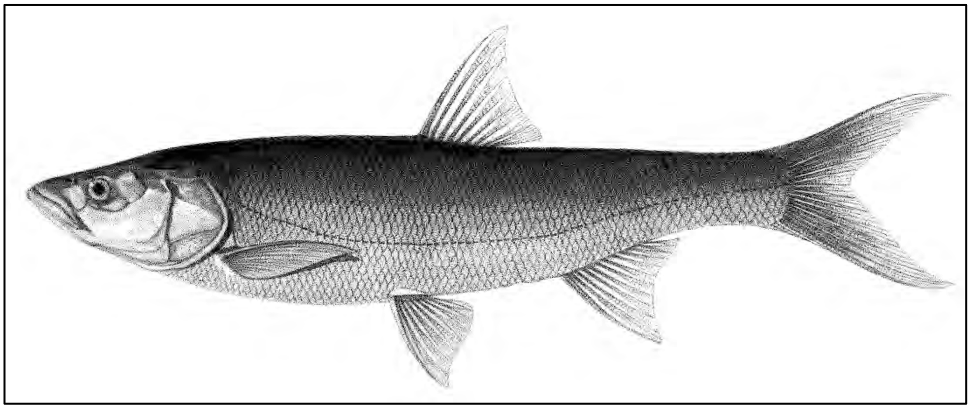
These are medium to large fishes with a somewhat compressed to elongate body, small to large scales, a complete lateral line, no barbels, mouth terminal, subterminal or superior, sometimes a large mouth with the lower jaw projecting and with a tubercle fitting into a notch in the upper jaw, thin lips with the lower one interrupted medially, a short dorsal fin without a thickened ray, a moderately long anal fin, long and hooked pharyngeal teeth in two rows (commonly 2 or 3,5-5, 3 or 2) usually with hooked tips and spoon-shaped crowns, short gut, no naked keel on the belly but a scaled keel in some, sometimes gill slits very wide such that the branchiostegal membranes attach under the posterior end of the eye, and short and relatively few gill rakers.

The following table summarises some key distinguishing characters of the Iranian species of *Leuciscus*.

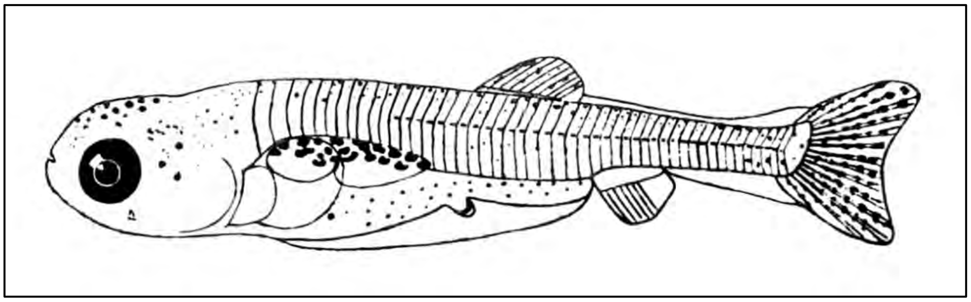
Species/Characters	Lateral line scales	Anal fin branched rays	Total gill rakers	Distribution
L. aspius	62-105	11-16 (mostly 12-13)	8-11 (mostly 8-9)	Caspian Sea
L. vorax	82-110	9-13	9-14	Tigris River

		(mostly 10-11)	(mostly 11-13)	

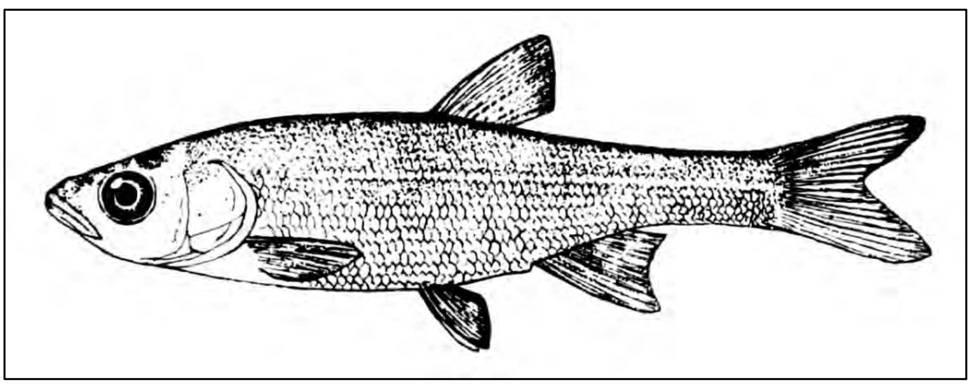
Leuciscus aspius
(Linnaeus, 1758)



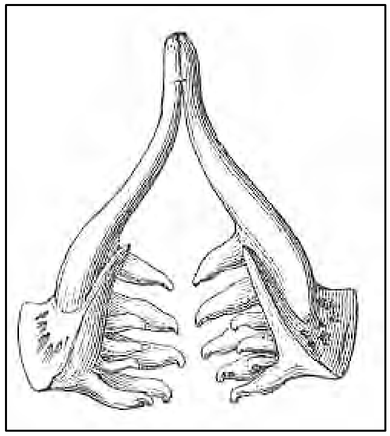
Leuciscus aspius 50.7 cm total length, ZISP 5205, Turkey, Lake Chaldyr-gel' (= Çıldır) in the former Kars Region (Aras River basin), after Berg (1948-1949).



Leuciscus aspius fry, 11.5 mm, age three weeks, Russia, Volga River delta, after Kazanskii (1925).



Leuciscus aspius fry, 41 mm, Kazakhstan, Ural River delta, after Berg (1932b).



Leuciscus aspius, pharyngeal teeth, after Seeley (1886).

Leuciscus aspius, Gilan, Anzali Shore, November 2010, Keyvan Abbasi.

Common names. Mash or mash mahi, khasham, mung fish (Amouei and Abdovali, 2014; mung being a bean and a translation of "mash", sometimes seen also as pea).

[Hasam or khasham in Azerbaijan; Kocaağız balığı in Turkish (Kaya *et al*., 2020); krasnogubyi zherekh or redlip asp in Russian; asp, Caspian asp, European asp, South Caspian asp].

Systematics. *Cyprinus Aspius* was described originally from lakes of Sweden; the types are unknown (Eschmeyer *et al*., 1996).

Cyprinus Rapax Leske, 1774 described from Leipzig, Germany, *Cyprinus taeniatus* Eichwald, 1831 described from the Kura River at Mingechaur, *Aspius erytrostomus* Kessler, 1877 (*sic*, sometimes spelt *erythrostomus* or *erithrostomus*) described in part from the Caspian Sea and Kura River, Azerbaijan and from the Aral Sea and lower part of the Amu Darya, Uzbekistan (all three with no types), and *Aspius transcaucasicus* Warpakhovskii, 1895 from the Lenkoran River and Lake Bussadagny, Azerbaijan, are synonyms. *Leuciscus aspius taeniatus* (Eichwald, 1831) is the subspecies found in the Caspian Sea.

Eschmeyer *et al*. (1996) gave *Aspius transcaucasicus* Varpakhovskii with the year 1896, although Berg (1948-1949) gave 1895; possibly the volume year is 1895 but the work did not appear until 1896. Varpakhovskii is a variant spelling in transliteration from the Russian and later in the *Catalog of Fishes* (downloaded 17 June 2019) it is spelled Warpachowski. Syntypes of this synonym are in the Zoological Institute, St. Petersburg under ZISP 10488 (2) and ZISP 10497-48 (*sic*, in Eschmeyer *et al*. (1996) but should read 10497-98 with five and two specimens respectively (Kottelat, 1997) and *Catalog of Fishes*, downloaded 31 March 2018).

Rezaei *et al*. (2012) examined fish from two fishing areas (Tonekabon and Sari) using meristics and morphometrics and found that the populations were distinct but with a relatively

high degree of overlap.

Poursaeid *et al*. (2014) described the karyology of hybrids with male *Rutilus frisii* (= *kutum*) (2n = 50 and NF = 80). Meknatkhah *et al*. (2016) recorded 16 morphometric and 6 meristic characters for this hybrid and found both intermediate and different characters in respect of the parents. Abbasi *et al*. (2021) analysed 101 specimens from the Aras River and the Astara, Anzali, Kiashahr and Langerud shores for 41 morphometric and nine meristic characters, finding significant differences in 27 morphometric characters which were more powerful in distinguishing populations than meristic characters. Upper caudal fin length and maximum body depth were effective characters in a principal components analysis.

The subspecies *L. a. taeniatus* may eventually be elevated to a species as has happened for other taxa in the Caspian Sea (see below for differences from the type subspecies). The limited material available to me did not permit a throrough analysis and fresh material would be needed for confirmatory DNA work.

Key characters. The subspecies of the southern Caspian Sea is distinguished from the type subspecies of Europe and the northern Caspian Sea since the former has higher lateral line scale counts of 67-90 as opposed to 64-76, lips are usually bright red, anal fin branched rays are usually 12 instead of 13 (but see Iranian fish below), and the height of the dorsal fin is usually shorter than the distance from the snout tip to the posterior edge of the preopercle (Berg, 1948-1949). Jaw characters and distribution serve to separate it from other leuciscids in Iran.

Morphology. The body is compressed and moderately deep. It is deepest between the end of the pectoral fin and the origin of the pelvic fin or over the end of the pectoral fin. The predorsal profile is convex. A nuchal hump may be present. The caudal peduncle is compressed and moderately deep. The head tapers and the snout is rounded to pointed. There is a groove across the head in front of the nostrils. The eye is positioned well into the anterior half of the head. The mouth is terminal and oblique and extends back level with the anterior eye margin. Lips are moderately thick. The lower jaw tip projects and fits into a notch in the upper jaw. Gill membranes are narrowly attached to the isthmus, almost under the posterior eye margin. The dorsal fin is slightly emarginate and its origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches level with the anterior anal fin or falls just short. The caudal fin is deeply forked with pointed lobes. The anal fin is markedly emarginate and does not extend back to the caudal fin base. The pelvic fin margin is round to straight or slightly emarginate and the fin does not extend back to the anal fin. The pectoral fin margin is straight or sickle-shaped and the fin does not extend back to the pelvic fin origin.

Dorsal fin unbranched rays 2-3, usually 3, branched rays 7-10, usually 8, anal fin unbranched rays 3-4, usually 3, and branched rays 11-16, usually 12-13, pectoral fin branched rays 14-18, and pelvic fin branched rays 7-9. Lateral line scales 62-105. There is a pelvic axillary scale and there is a scaled keel behind the pelvic fins. The scales have a central focus, fine circuli and few posterior and anterior radii. Total gill rakers number 8-11, very short and club-shaped, almost or not reaching half way to the raker below when appressed. Pharyngeal teeth are usually 3,5-5,3, sometimes 2,5-5,3 or with 6 teeth in the main row, teeth elongate, compressed and obviously hooked. The gut is an elongate s-shape. Total vertebrae number 47-51, mostly 50 (Berg, 1948-1949). The chromosome number is 2n = 50-52 (Klinkhardt *et al*., 1995; Arai, 2011).

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(6), anal fin branched rays 13(6), pectoral fin branched rays 18(3), pelvic fin branched rays 8(3), lateral line scales 68(1) …., 72(2), 73(1), 74(1) or 75(2), total gill rakers 8(1) or 9(2), pharyngeal teeth 3,5-5,3(3), and total vertebrae 50(2) or 51(1).

Sexual dimorphism. Mature males have the body covered in tubercles (Berg, 1948-1949). Abdurakhmanov (1962) noted greater head depth, lower caudal fin lobe length and pelvic fin length in males and greater body depth and pectoral to pelvic fin distance in females. Seven other morphometric characters differed between sexes in one population examined but not in another so sexual morphology is quite variable.

Colour. The overall colour is silvery with the back a blackish-olive or greenish-grey. The iris is silvery with a narrow golden circle around the pupil and a little grey pigment on the upper half. Lips are silvery with a little grey over the upper one. Both lips and iris are often bright red. The dorsal and caudal fins are grey with dark tips and the other fins are transparent without pigment or may also be grey. All fins may be tinged reddish or dark red. The peritoneum is silvery to brown.

Size. Reportedly attains 1.2 m and 20.0 kg, possibly over 30.0 kg (Machacek (1983-2012), downloaded 27 July 2012). The largest of 12,000 fish from the lower Kura River was 77.0 cm total length, males averaged 61.0 cm and females 64.0 cm. The average weight of 105,500 fish caught in 1927-1929 was 2.72 kg, females 2.93 kg (based on 1,500 fish), males 2.34 kg and the heaviest fish was 5.5 kg (Berg, 1948-1949).

Distribution. Found from the Rhine and north of the Alps in Europe to the drainages of the Black, Caspian and Aral seas including their southern shores.

In the Iranian Caspian Sea this species has been reported from Astara to Gorgan Bay including the Aras, Gorgan, Sari, Sefid, Shah, Shalman, Sheikan and Tonekabon rivers, the Aras Dam, and in the Iranian Caspian Sea such as at the Kiashahr and Langerud shores (Nedoshivin and Iljin, 1929; Derzhavin, 1934; Berg, 1948-1949; Abbasi *et al*., 1999; Kiabi *et al*., 1999; Abdoli, 2000; Masoumian *et al*., 2002; Naderi Jolodar and Abdoli, 2004; Abdoli and Naderi, 2009; Rezaei *et al*., 2012; Mouludi-Saleh *et al*., 2021). Formerly reported from the Anzali Talab but no longer present (Holčík and Oláh, 1992) although reported from the Siahkeshim Protected Region of the Anzali Talab and Anzali Shore by Riazi (1996), Anzali Talab by Karimpour (1998) and the Anzali Shore by K. Abbasi (see photograph above) and the Siah Darvishan River, the Anzali Talab and its mouth (Abbasi *et al*., 2007, 2017). A record of parasites from this fish caught in the Mahabad Dam of the Lake Urmia basin is either a misidentification or a transplant (Masoumian *et al*., 2002).

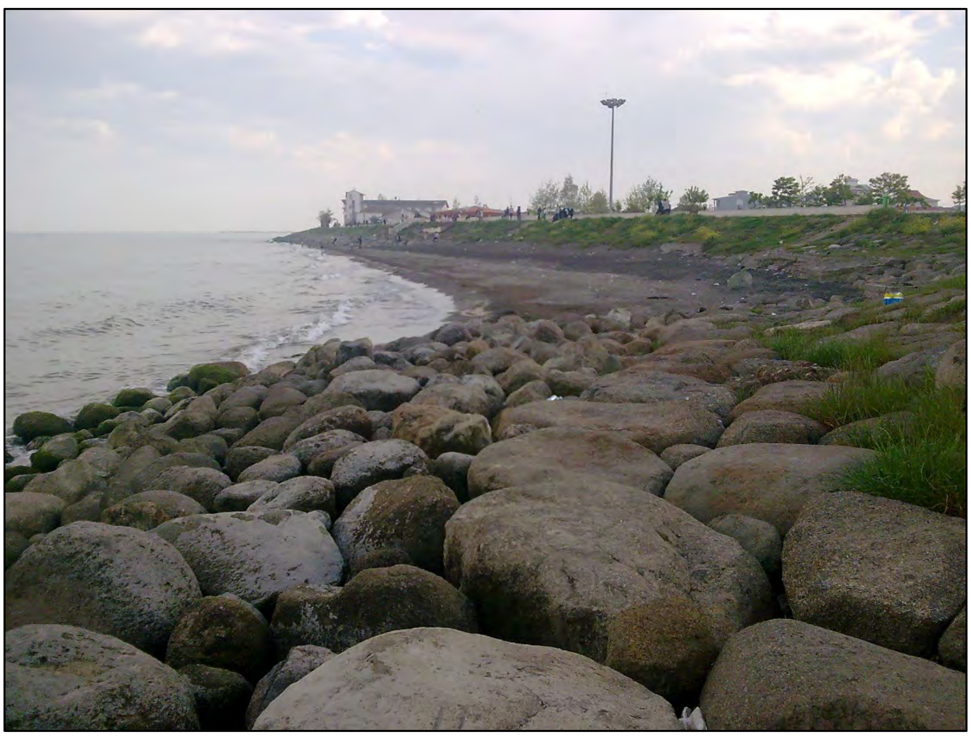
Also recorded from the Uzboi lakes, Karakum Canal and Kopetdag Reservoir in Turkmenistan (Shakirova and Sukhanova, 1994; Sal'nikov, 1995) and may eventually appear in the Tedzhen (= Hari) River basin in Iran.

Zoogeography. The closest relative of this species lies to the south and indicates a connection between Euro-Mediterranean and/or Black-Caspian-Aral seas basins.

Habitat. This species is found in rivers, streams, lakes, canals, dams, marshes and brackish environments, usually in open areas. This species prefers running water (Berg, 1948-1949). Knipovich (1921) reported this species from depths of 14.6-16.5 m, and possibly deeper, in the Iranian Caspian Sea. Riazi (1996) stated that this species is native (resident) to the Siahkeshim Protected Region of the Anzali Talab. It was solitary, rarely in small groups as on the spawning migration. In the waters of Dagestan, asps began to migrate upriver in October, peaking at the end of November and the beginning of December. The Kura River run was from November to February, peaking in December at 6ºC, with spawning in middle March and ending by the end of April. They overwintered in deep holes, emerging in early spring as rivers flooded and moved to the spawning grounds. These grounds included river channels, open lake areas with substantial flow and only rarely places weakly overgrown with very coarse submerged

vegetation such as reeds and rushes. After spawning the asps returned to the Caspian Sea (Shikhshabekov, 1979). Fry migrated to the sea from June until August at 3-4 months of age and 5-10 cm length (Berg, 1948-1949).

Age and growth. Fish taken from commercial catches in Iran were mostly 3-6 years old, 38.1-56.7 cm long and weigh 631-2,241 g (Razivi *et al*., 1972) or 3-6 years and 33-63 cm total length (Holčík and Oláh, 1992). Growth was rapid in the latter report, fish reaching 1.0 kg during the fourth year of life. Maximum life span may be 15 years and Rezaei *et al*. (2012) reported fish up to 10^+ years in Iran. Amouei and Abdovali (2014) showed that weight and length of otoliths best correlated with age although they only examined fish ages 2 and 3 years. The *b* value was 3.15 indicating isometric growth based on 50 fish, 22-38 cm total length. Dejandian *et al*. (2017) examined 20 fish from Iran and found males attained 4^+ years and females 5^+ years and these were at stage 4 maturity. Mouludi-Saleh *et al*. (2020) examined 96 specimens from the Aras River and the Astara, Anzali and Kiashahr coasts of Gilan, and found *b* values ranged from 2.75 to 3.28 and condition factor from 0.85 to 0.95. Maximum and minimum *b* values were in the Astara and Kiashahr populations, respectively, and maximum and minimum condition factors were in the Astara and Anzali populations. Growth patterns were positively allometric except for the Kiashahr population. Mouludi-Saleh *et al*. (2021) examined 133 fish, 17.2-68.5 cm total length, from the Aras River and Gilan and Mazandaran coasts and recorded a *b* value of 3.07, isometric, and a condition factor of 0.91.



Gilan, Caspian Sea at Astara (Caspian Sea-Astara, CC BY-SA 3.0, Samaksasanian).

Life span in the Volga delta was 7-8 years with the bulk of the population mature at 6 years (Ali, 1974). In the waters of Dagestan life span was 8 years with maturity at 4 years. Mature males and females were 41-58 cm long and weighed 840-2,800 g (Shikhshabekov, 1979). Growth was more rapid in the Kura River of Azerbaijan than in other rivers in the former Soviet

Union.

Food. This species is a solitary predator on other fishes such as roaches (*Rutilu*s spp.), gobies (Gobiidae) and silversides (Atherinidae), frogs and even ducklings. It may catch other fishes by plunging into shoals at the surface and may leap out of the water as a result. An Iranian specimen had the remains of a large crustacean in its gut. Abdoli (2000) reported *Scardinius erythrophthalmus*, *Atherina boyeri* (= *A. caspia*, Caspian silverside) and *Blicca bjoerkna* as food items in Iran. Surface insects are also eaten. Young feed on plankton initially but start to take the fry of fishes at 2-3 months. There is little feeding on the spawning migration.

Reproduction. The spawning season in Gilan is mid-February to late March at 10-13°C with an incubation period of 9-10 days (Hoseinie, 1995).

Spawning was non-intermittent and the period is short (10-15 days) in Dagestan (Shikhshabekov, 1979). Fecundity reached 483,500 eggs in the south Caspian Sea and maximum egg diameter in the Volga delta was 1.7 mm (Ali, 1974). In Hoseinie's (1995) study of artificial propagation of this species in Iran, large or swollen eggs numbered 117-277 per gramme, and egg diameters 2.0-2.2 mm. Absolute fecundity reached 264,248 eggs. Abdurakhmanov (1962) gave a maximum fecundity of 342,000 eggs and a maximum egg diameter of 2.4 mm for Azerbaijan populations. Females with ripe eggs were found between mid-April and mid-May at water temperatures of 4.0-12.2°C, optimally 9-11°C. Up to 20% of Volga asp females did not spawn annually. Eggs developed while between or adhering to stones on the river bed. Young migrated downriver from June to August at age 3-4 months and 5-10 cm length.

Berg (1948-1949) gave details of spawning in the Terek, Volga and Ural rivers of the Caspian Sea.

Parasites and predators. Molnár and Jalali (1992) recorded the monogenean *Dactylogyrus tuba* from this species in the Sefid River. Masoumian *et al*. (2005) reported the protozoan parasite *Chilodonella*, sp. from this species in the Aras Dam in West Azarbayjan. Masoumian *et al*. (2002) investigated parasites from this fish in the Aras and Mahabad dams (*sic* - see **Distribution**) in northwest Iran and found the protozoan *Myxobolus dispar*. Sattari *et al*. (2002, 2004, 2005) and Sattari (2004) recorded the presence of the nematode, *Eustrongylides excisus*. This parasite can damage muscles in commercial species and render them unsuitable for sale. Pazooki *et al*. (2007) recorded various parasites from localities in West Azarbayjan Province, including *Argulus foliaceus* from this species. Sattari *et al*. (2008) reported the nematode *Eustrongylides excisus* from fish along the southern Caspian Sea shore. Rasouli (2013) found the digenean *Diplostomum spathaceum* in fish from Caspian drainages in West Azarbayjan. This parasite causes secondary infections as the metacercariae penetrate the skin and eye, resulting in lesions, appetite loss, blurry vision and reduced feeding.

The Caspian seal, *Pusa caspica*, is a predator (Krylov, 1984).

Economic importance. This fish is taken in Iran as food but comprises only a small portion of the catch. Nevraev (1929) reported catches of 267 to 2,429 fish for the period 1914-1915 to 1917-1918 in the Anzali region. Holčík and Oláh (1992) recorded the catch in the Anzali region for 1969-1970 and 1970-1971 as 45.2 t and 36.1 t respectively, these being 84% and 69% of the total Iranian catch. In 1921-1930, the annual catch in the lower Kura River averaged 249,000 fish and in 1936 for Azerbaijan the catch weighed 8,100 centners and numbered 300,000 fish.

Falahatkar *et al*. (2015) examined growth of the aspikutum (*Leuciscus aspius* ♀ x *Rutilus frisii* ((= *R. kutum*) ♂) in earthen ponds and concrete tanks, the former showing higher growth performance because of natural live food in addition to the commercial feed. Falahatkar *et al*.

(2019) determined the influence of stocking density in concrete tanks on this hybrid. Improved growth performance and changes in blood parameters showed that a density of 10 kg/cu m or more could be applied to rearing under commercial culture conditions.

Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use as food and in sport. The flesh is white and tasty but rather tough.

Experimental studies.

Abbaszadeh and Şişman (2021) determined the histopathologic effects of water pollution on this species. Hypertrophy, filament dilatation, lamellar epithelial liftings, thickening of filaments, especially curving, a decrease of the mean length, necrosis, fusion, and lifting in lamellae were observed in the gills. The main histopathological abnormalities in the liver were non-homogenous parenchyma, the proliferation of hepatopancreas, congestion, degeneration of the central vein, increasing melanomacrophage aggregates, and sinusoidal dilations. Changes in the kidney included the degeneration of renal tubules, increasing melanomacrophage aggregates, pyknotic nuclei and vacuolization in proximal and distal tubule epithelial cells, and lymphocyte infiltration in the renal parenchyma. The frequencies of the histological lesions were higher in the liver compared to other organs

Haghparast *et al*. (2014, 2020) examined the hybrid of the female of this species with the male of *Rutilus frisii* (= *R. kutum*) for the effects of differing protein and lipid levels in the diet. A diet with 35% protein and 15% lipid gave optimum growth in this hybrid, while no effects on biochemical and haematological parameters were achieved. Bagheri *et al*. (2015) found that this hybrid could be reared at a density of 10 kg/cu m or more without negative effects on growth performance and feeding and Falahatkar *et al*. (2019) determined the influence of stocking density in concrete tanks on this hybrid where improved growth performance and changes in blood parameters also showed that a density of 10 kg/cu m or more could be applied to rearing under commercial culture conditions. Falahatkar *et al*. (2015) examined growth of the hybrid or aspikutum in earthen ponds and concrete tanks, the former showing higher growth performance because of natural live food in addition to the commercial feed. Falahatkar *et al*. (2019) suggested increasing dietary fat levels in this hybrid up to 16% for better growth performance.

Falahatkar *et al*. (2010) studied induced spawning using ovaprim (a commercial spawning inducing agent) and carp pituitary extract. Falahatkar and Tolouei Gilani (2009, 2013) used laparoscopy for sex identification in aquaculture.

Conservation. Recruitment in this species is low in Iran because water is taken from the summer spawning streams for irrigation purposes. Spawning success is therefore limited. Larvae of spring spawners were lost when they entered irrigation channels and become stranded in fields (Razivi *et al*., 1972). Holčík and Oláh (1992) considered the decline in this species to be due to indiscriminate catching of sexually immature fish and, in the Anzali Talab at least, environmental changes. The Pol-e Astaneh Fish Farm has studied propagation of this species (Keivany and Nasrollahzadeh, 1990) and Hoseinie (1995) demonstrated that artificial propagation was possible. It has also been raised to marketable size in ponds through artificial feeding with ground kilka (*Clupeonella* spp., Clupeidae) and a rice product (*Annual Bulletin 1993-94, Iranian Fisheries Research and Training Organization, Tehran,* pp. 81-82, 1995). The Shahid Beheshti hatchery on the Sefid River bred this species (Raymakers, 2002). The asp was bred in the Varvarinsk Hatchery in Azerbaijan and releases of up to 1.5 million yearlings were made into the Kura River, with plans for 8-10 million releases (Kosarev and Yablonskaya, 1994).

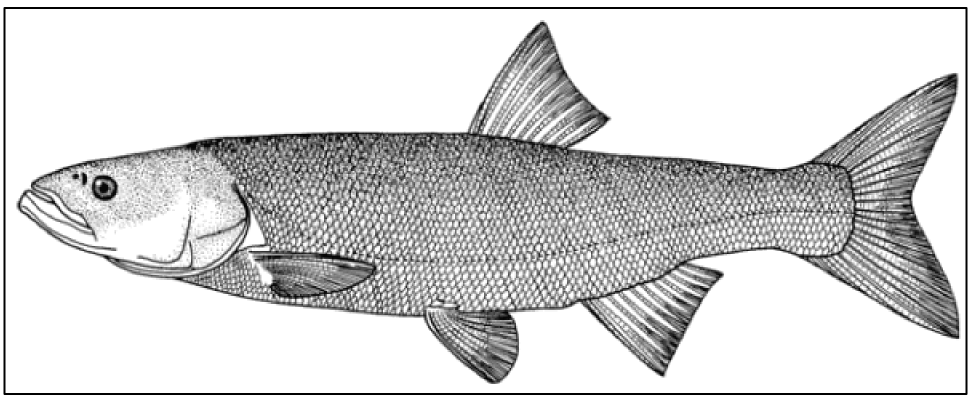
Lelek (1987) classified this species as vulnerable to endangered in Europe. Vulnerable in

Turkey (Fricke *et al*., 2007). Kiabi *et al*. (1999) considered this species to be data deficient in the south Caspian Sea basin according to IUCN criteria. Criteria included commercial fishing, habitat destruction, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and absent outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Iranian material:- CMNFI 1970-0526, 2, 236.8-246.1 mm standard length, Gilan, Sefid River below Astaneh Bridge (37º19'N, 49º57'30"E); CMNFI 1980-0494, 1, 319.6 mm standard length, Iran, Caspian Sea basin (no other locality data); ZISP 3917, 1, 402.0 mm standard length, Gilan, Anzali (no other locality data).

Comparative material:- ZISP 3653, 2, 128.4-144.2 mm standard length, Uzbekistan, Kashkana-tau, Amu Darya delta (no other locality data); ZISP 3654, 2, 196.4-197.8 mm standard length, Uzbekistan, Kashkana-tau, Amu Darya delta (no other locality data); ZISP 3655, 2, 162.1-193.4 mm standard length, Uzbekistan, Kashkana-tau, Amu Darya delta (no other locality data); ZISP 3704, 1, 183.6 mm standard length, Uzbekistan, Amu Darya, Karakul (no other locality data); ZISP 13267, 1, 263.1 mm standard length, Kazakhstan, Kazalinsk (no other locality data).

Leuciscus vorax
(Heckel, 1843)



Leuciscus vorax
Susan Laurie-Bourque @ Canadian Museum of Nature.

Leuciscus vorax, Khuzestan, Hawr al Azim, Asghar Mobaraki.

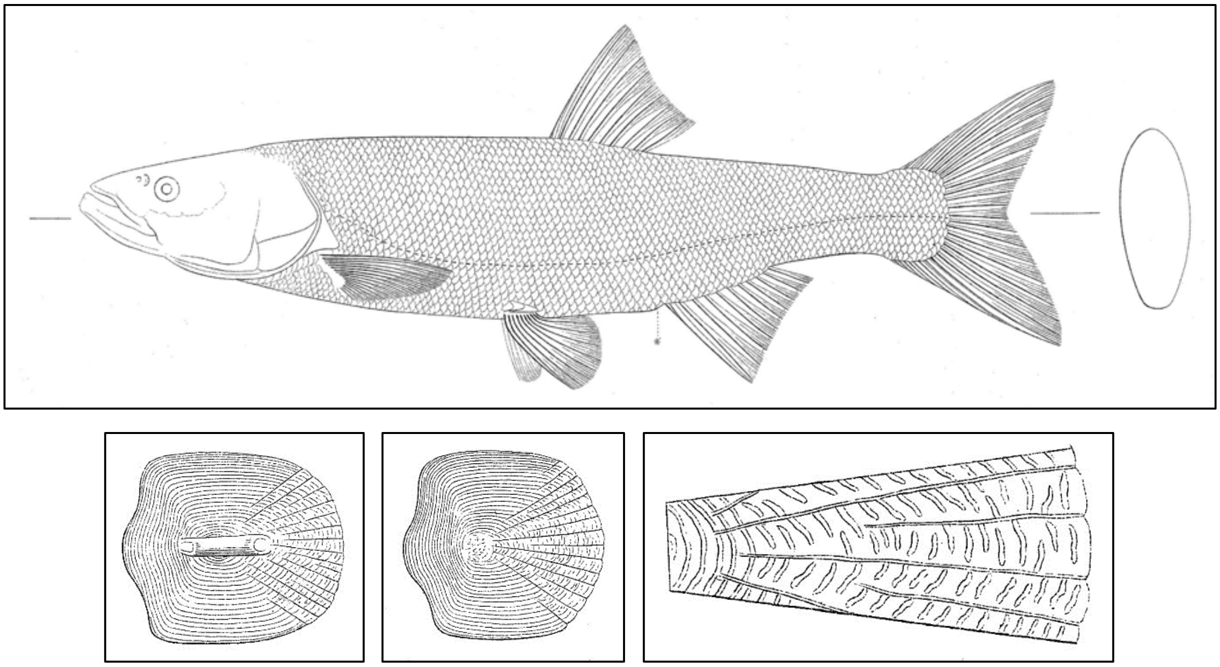
Leuciscus vorax, Iraq, P. Tifft.

Leuciscus vorax, head, Khuzestan, Dez River, Brian W. Coad.

Common names. Shelej, shalaj, sholge, sholgeh (see below), mashmahi-ye jonoub (= southern pea fish (pea may not be the correct translation of “mash” but rather mung bean).

[Shilik, shillik, shillig, shiliq, shelej, shalaj, sholgeh (perhaps from shilig = a cucumber-shaped melon (Mikaili and Shayegh, 2011); abu elawi and bu aliawi (abu alawi = belonging to ali (Mikaili and Shayegh, 2011)); called “snake” by American soldiers in Iraq because of the name asp being familiar as the snake that killed Cleopatra; kaschschasch (= voracious) from Heckel (1843b), all in Arabic; Sis balığı in Turkish (Çiçek *et al*., 2020); Mesopotamian asp, Tigris asp].

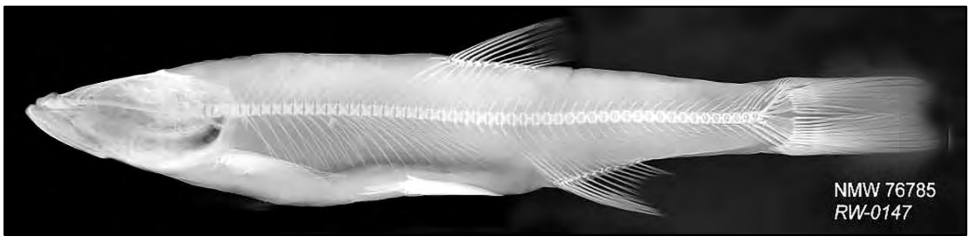
Systematics. The type locality for *Aspius vorax* is the “Tigris bei Mossul” according to Heckel (1843b). Krupp (1985c) reported, and I have examined, a specimen named as a syntype held in the Naturhistorisches Museum Wien under NMW 76776, 261.4 mm standard length. The catalogue in Vienna in 1997 listed NMW 76785 as a type and this specimen is also 261.4 mm standard length. Eschmeyer *et al*. (1996) listed a dried skin as a syntype under NMW 16527. The catalogue in Vienna listed four fish in spirits and two fish stuffed so there are presumably more types than the three mentioned here.



Aspius vorax,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Aspius vorax, syntype, NMW 16527, Naturhistorisches Museum, Wien.

Aspius vorax, syntype, NMW 76785, Naturhistorisches Museum, Wien.



Aspius vorax, syntype, NMW 76785, Naturhistorisches Museum, Wien.

Banister (1980) suggested that this species may be close to *Aspius* (= *Leuciscus*) *aspius*, perhaps a clinal variant, since the Caspian Sea basin subspecies, *L. a. taeniatus* has scale counts (67-90) intermediate between European populations of *L. aspius* (65-74) and *L. vorax* (93-105) (Banister's figures). However, this may be more apparent than real as there is considerable overlap and frequency distributions were not given. There was insufficient material on hand from Iran to investigate this character in more detail.

Key characters. Head and jaw characters coupled with distribution serve to identify this species.

Morphology. The body is compressed and moderately deep or shallow. It is deepest half way between the dorsal fin and the head. The predorsal profile is almost straight to somewhat convex especially near the head. A nuchal hump may be present. The caudal peduncle is compressed and moderately deep. The head is long and tapers anteriorly, being very pointed. The dorsal head profile may be concave or straight. The eye is well into the anterior half of the head. The mouth is oblique and elongate reaching back to the anterior half of the eye. The lower jaw projects and has a symphysis knob fitting into an upper jaw notch. The upper lip is thin and the lower lip is thick. The gill opening is large and extends forward to the posterior eye margin level. Fins are more falcate than in the line illustration when partially collapsed. The dorsal fin is emarginate and its origin is well posterior to the level of the pelvic fin origin. The depressed dorsal fin extends back almost level with the middle of the anal fin. The caudal fin is deeply forked with rounded to pointed tips, the lower lobe being longer. The anal fin is usually emarginate, sometimes markedly so, and it does not extend back to the caudal fin. The pelvic fin has a straight margin and the fin does not extend back to the anal fin. The pectoral fin is rounded and does not extend back to the pelvic fin.

Dorsal fin with 2-3 unbranched and 7-9, usually 8, branched rays. Al-Nasiri *et al*. (1975) gave a range of 8-11 (probably 7-10 using my system of counting) dorsal fin rays with a strong mode at 9 (i.e., 8) for 271 fish taken from the Basrah fish market from January to June. Anal fin with 2-3 unbranched and 9-13 branched rays. Al-Nasiri *et al*. (1975) gave a range of 10-13 (9-12, 10 modally but high frequencies at 11 too). Pectoral fin branched rays 16-18 (Al-Nasiri *et al*. (1975) gave 14-18, modally 16), and pelvic fin branched rays 8-9, usually 8. Lateral line scales

82-110, lateral line low on the flank anteriorly, rising to the midline of the caudal peduncle. There is a pelvic axillary scale. Scale shape is squarish with a rounded posterior margin and gently rounded dorsal and ventral margins. The anterior margin has a rounded centre with an indentation above and below, and rounded scale corners. Scales have a few radii on the posterior field only, a central focus and numerous, fine, concentric circuli. Pharyngeal teeth are 3,5-5,3 with variants 2,5-5,3 and 2,5-5,2, and are long, compressed and hooked at the tip. Total gill rakers number 9-14, some reaching the base of the adjacent raker when appressed but widely spaced and not developed anteriorly. Al-Nasiri *et al*. (1975) gave a range of 11-13 gill rakers with a strong mode at 12. The gut is an elongate s-shape. Total vertebrae number 51-53. Al-Nasiri *et al*. (1975) gave 37 as a count which cannot be reconciled with my counts. The syntype, NMW 76785, has 51 total vertebrae.

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(4), anal fin branched rays 10(1) or 11(3), pectoral fin branched rays 16(1) or 17(3), pelvic fin branched rays 8(4), lateral line scales 96(1), 97(-), 98(1), 99(-) or 100(1), total gill rakers 11(1), 12(2) or 13(1), pharyngeal teeth 3,5-5,3(3), and total vertebrae 51(3) or 53(1).

Sexual dimorphism. Unknown.

Colour. The back is greenish to blackish but overall colour is silvery-grey or silvery-white. Fins are said to be all pale yellow in live fish but are red or dark in some preserved and freshly-caught specimens. A photograph of one freshly caught specimen showed reddish pectoral, pelvic and anal fins, with the dorsal fin greenish, similar to the back and flanks. Another freshly caught specimen was overall silvery, with a brownish-green back, fins overall grey with some yellowish tinges. The peritoneum is black to brown.

Size. Reaches over 55.0 cm total length and 6.0 kg in Iraq (van den Eelaart, 1954; Herzog, 1967; Shafi and Jasim, 1982; Bartel *et al*., 1986) and 1.5 m and 60.0 kg in the Euphrates (Gruvel, 1931; if identification is correct). The Suq al-Shouykh Marsh in April 2005 contained specimens larger than 65.0 cm (www.iraqmarshes.org, downloaded 29 August 2005) and fish in Baghdad palace ponds were estimated to reach 36-40 inches (91-1.02 m) and 15-20 pounds (6.8-9.1 kg) (http://members.cox.net/flybox/FishingUpdate.htm, downloaded 9 January 2006). Hashemi *et al*. (2013) recorded a maximum total length of 40.5 cm and 0.6 kg for 188 fish from the Shadegan Marsh in Iran.

Distribution. This species is found in the Tigris-Euphrates and the Orontes (= Asi) River basins in the Middle East. In Iran it is recorded from the lower reaches of rivers in the Tigris River basin including the Arvand, Bahmanshir, Dez, Jarrahi, Kahnak, Karkheh, Karun, Qareh Su-Gamasiab-Simareh and Shate-Neisan rivers and also such marshes as the Hawr al Azim and Shadegan (Marammazi, 1995; Velayatzadeh and Abdollahi, 2011; Hashemi *et al*., 2013; Khamees *et al*., 2019).

Zoogeography. This is one of several species that has a sister taxon in the Euro-Mediterranean and/or Black-Caspian-Aral seas basin, indicating north-south connections in the past.

Habitat. This species is found in rivers, streams, lakes, dams, ponds and marshes. van den Eelaart (1954) studied this species in Iraq and found that it lived in rivers, lakes and marshes in both open and vegetated areas and remained in shallow water even in summer. It also occurred in smaller water bodies such as ponds. From spring to fall it was found mainly in marshes and lakes. The barrages at Hindiyah and Kut blocked the upstream migration of this species (Mahdi, 1962). Lakes at Camp Slayer in Baghdad contained this species and, in the shallows, the larger fish chased smaller fish and smaller species leaving v-shaped wakes with the tail fin exposed.

Smaller fish leapt out of the water to escape this predator (http://members.cox.net/flybox/FishingUpdate.htm, downloaded 9 January 2006).

Age and growth. Hashemi *et al*. (2013) examined 188 fresh fish (11.5-40.5 cm total length) from the Shadegan Wetland or Marsh and found length-weight relationships were $W = 0.06TL^{3.03}$ and $W = 0.06TL^{3.02}$ for males and females respectively, showing no difference between sexes and positive allometry. A later study by Hashemi *et al*. (2016) on 456 fish, 11.5-47.5 cm total length, in Shadegan found negative allometric growth (*b* = 2.88), length and weight at maturity were 26.6 cm and 162 g, production rate per biomass annually was 0.44, growth indices were L_∞ = 49.8 cm, growth rate (K) = 0.45/yr, and t_0 = -0.16, the species being medium vulnerable.

Shafi and Jasim (1982) made observations on the biology of this cyprinid in Habbaniyah Reservoir, Iraq. They reported 8 age groups with most rapid growth in summer months when water temperatures are above 25°C. Growth in weight was about 160.1 g per year to the fourth year of life and about 331.0 g per year afterwards. Condition factor was 0.74-1.18 with a mean of 1.0, stable values probably related to piscivory. The length-weight relationship was $W = 0.0123TL^{3.0601}$. The von Bertalanffy equation for growth was $l_t = 91.0[1-e^{-0.122}(t-0.25)]$. Ali *et al*. (1986) found the condition factor to range from 0.05 to 1.09 (mean 0.73) and also gave the chemical composition and calorific value. This species had a higher fat content than *Barbus* (= *Carasobarbus*) *luteus* with which it was studied. Al-Dabical and Al-Daham (1995) studied growth in the first year of life in fish from the Shatt al Basrah Canal, Iraq and gave the length-weight relationship as $\log_e W = -12.458 + 3.077 \log_e L$ and the growth equation as $L_t = 104.118 (1-e^{-0.0121 (t - 87.871)})$. Epler *et al*. (2001) found the oldest age groups to be 5^+, 6^+ and 7^+ in Iraqi lakes Razzazah, Habbaniyah and Tharthar respectively. The mean condition factor was 0.87, 0.88 and 0.76 respectively. The von Bertalanffy parameters were for Lake Tharthar L_∞ (cm) = 145.5, K = 0.0803, t_0 = -0.3269, W_∞ (g) = 32099 and n = 3.2249. These indicated rather uniform growth rates, as L_∞ is relatively high and K very low. Results were considered more reliable than an earlier study by Jasim (1980) which used inappropriate methods. Annual survival in Lake Tharthar for fish 2.6-5.5 years was 62.0% (Szczerbowski *et al*., 2001). Productivity was low based on chemical and limnological studies, limiting fish production. Fish in the East Hammar Marsh, Iraq had dominant length groups 17-38 cm, a *b* value of 3.085 (positive allometric growth), a maximum age of 8 years, L_∞ = 65.0 cm. K = 0.21, the sex ratio favoured females, and there was a short spawning season (Mohamed *et al*., 2017). Al-Jubouri (2019) examined 495 fish, total length 10-54 cm, from the Al-Diwaniyah River, Iraq and found this species comprised 5.66% of the fish assemblage, $W = 0.0069L^{3.0245}$, the sex ratio differed significantly from 1:1 in favour of females, mean values of relative condition factor for small fish, males and females were 0.9, 0.95 and 1.05, respectively, eight age groups were recognized with lengths 14.3, 23.4, 31.0, 38.2, 42.9, 45.9, 48.7 and 51.5 cm, length group 17 cm dominated, and von Bertalanffy growth constants were L_∞ = 61 cm, K = 0.226 and t_o = -0.195. The growth performance index (Φ) was 2.92. The total (Z), natural (M) and fishing (F) mortality rates were assessed by applying the length cohort analysis and were 0.619, 0.255 and 0.364, respectively. The exploitation rate (E) estimate was 0.588, exceeding the optimal level of exploitation (E = 0.5), so this fish stock was overexploited. The following report was presumably based, at least in part, on this thesis. Mohamed and Al-Jubouri (2020c) examined 501 fish from the Al-Diwaniya River, Iraq and found this species constituted about 6.4% of the fish assemblage, there were 8 age groups, the total length of all individuals ranged from 10.2 to 55.5 cm, the length-weight relationship was calculated as $W = 0.007L^{3.035}$ and growth was isometric, the mean value of the relative condition

factor was 0.98, von Bertalanffy growth parameters were L_∞ = 61.0 cm, K = 0.227 and t_0 = -0.196 years, the growth performance index (Φ) was found to be 2.93, the overall male to female ratio was 1:1.51, and length at maturity was 29 cm for males and 31 cm for females.

Food. This fish is piscivorous, feeding almost entirely on fish when adult according to Iraqi studies (Shafi and Jasim, 1982), although aufwuchs may also be found in gut contents. It is mainly a mid-water and benthic feeder with limited predation on surface water organisms (Hussein and Al-Kanaani, 1991). The gill rakers are widely spaced, indicative of a piscivorous diet (Salman *et al*., 1994) and, in a separate study, the gut was a short s-shape, about equal to fish standard length, also indicative of a piscivorous diet (Salman *et al*., 1994). The mullet, *Liza* (= *Planiliza*) *abu* (abu mullet), is an important food fish (Al-Shamma'a and Jasim, 1993). There is a gradual shift from small- to large-sized fish prey as this species grows (Salman *et al*., 1994). Frogs, molluscs and aquatic plants and algae were also found in stomach contents, with frogs being important to large fish in terms of prey volume. Plants may be accidental inclusions taken when seizing prey in weed beds. The fish eaten in descending order of importance were *Liza* (= *Planiliza*) *abu* (abu mullet), *Gambusia affinis* (*sic*, probably *G. holbrooki*, eastern mosquitofish), *Garra rufa* and *Cyprinus carpio*. The main crustacean eaten was *Metapenaeus affinis* along with decapods and amphipods.

Hussein *et al*. (1993) examined diet in the Garma Marshes, Iraq and found aquatic insects and crustaceans to be important in young fish in both summer and winter, with molluscs and fish less important. Even in large members of this species, fish were outranked by aquatic insects and in winter by crustaceans as well. Molluscs were a minor food. This species rejected certain molluscs while taking others, attributed to variations in shell thickness and attachment strength to substrates.

Hussein and Al-Kanaani (1989, 1991, 1994) examined the diet of this species in the Al-Hammar Marsh and found a gradually reduced feeding intensity towards the winter months, a highest fullness index in May and lowest in January, and a diet governed by food accessibility and availability. Crustaceans, fish and aquatic insects are the main food items in descending order of importance, with fish most important when using a percentage ranking index in large specimens and even in small ones by volume. Benthic molluscs were the third most important food for young fish after crustaceans and fish. In a study of the recovering Hammar Marsh, Iraq, diet was 80.0% fish and 20.0% insects, in the Hawr al Hawizeh 47.4% fish and 29.4% insects with shrimps, other crustaceans, algae, diatoms, plants and snails at less than 10% each, and in the Al Kaba'ish (= Chabaish) Marsh 73.0% fish and 16.8% insects with shrimps, other crustaceans, algae and plants at less than 10% each (Hussain *et al*., 2006). Hussain and Ali (2006) examined feeding relationships among fishes in the Al-Hammar Marsh and found this species to be a carnivore, 41.9% of the diet being crustaceans, 10.0% insects and 34.1% fishes.

Epler *et al*. (2001) studied the diet of this species in Lake Tharthar, Iraq and found year-old fish to be eating oligochaetes, tendipedids and plant material with only fish in the diet of two- to seven-year-old specimens. Dietary coincidence with *Luciobarbus esocinus* was high in Lake Tharthar, 96.1%. Jubouri (2019) and Mohamed and Al-Jubouri (2020c) examining fish from the Al-Diwaniya River, Iraq found the feeding intensity and feeding activity were low during winter and high during summer. The species was a carnivore and fed mainly on fishes (49.5%), shrimps (24.9%), aquatic insects (9.5%), crustaceans (8.1%) and algae (8.0%). Large individuals fed mainly on fishes (58.1%), shrimps (24.3%), insects (10.9%) and crustaceans (6.6%).

Reproduction. Hashemi *et al*. (2016) found fish in Shadegan Marsh spawned in January and February.

van den Eelaart (1954) found this species in deep parts of Iraqi rivers in December-January, entering marshes and lakes in February to spawn at the end of February and the beginning of March. Spawning took place on gravel beds, the same as those used by *Barbus* (= *Luciobarbus*) *xanthopterus*, but also on plants. Shafi and Jasim (1982) recorded possible spawning in January at 10°C in Iraq with a fecundity up to 74,509 eggs, a mean of 1,157 eggs/g body weight and egg diameter of about 1.1 mm. Epler *et al*. (2001) studied reproduction in Iraqi lakes Tharthar and Habbaniyah and found males to achieve maturity in the third year of life at 44.2 cm and females in the fourth at 47.2 cm. Spawning occurred in February at 13-14ºC. Fecundity was 92,000 eggs/kg body mass. Jubouri (2019) and Mohamed and Al-Jubouri (2020c) examining fish from the Al-Diwaniya River, Iraq found the maximum gonadosomatic index (9.37 for females and 4.4 for males) was in January then dropped dramatically for both sexes, suggesting that the species may spawn in February.

Parasites and predators. Jalali and Molnár (1990a) recorded the monogeneans *Dactylogyrus mokhayeri* and *D. pulcher* from this species in the Dez River. Moghainemi and Abbasi (1992) reported a wide range of parasites from this species in the Hawr al Azim in Khuzestan. Mortezaei *et al*. (2000) recorded an infection rate of 6.6% with the worm *Neoechinorhynchus tylosuri* in Khuzestan marshes. Farahnak (2000a, 2000b), Farahnak *et al*. (2002) and Moumeni *et al*. (2020) recorded *Contracaecum* sp. and *Anisakis* sp. from this fish in Khuzestan, both zoonotics. Barzegar *et al*. (2008) reported the digenean eye parasite *Diplostomum spathaceum* from this fish. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Argulus* sp., *Ergasilus* sp., *Ergasilus sieboldi*, *Lernaea* sp., *Lamproglena* sp. and *Lamproglena compacta* on this species.

It is eaten by *Silurus triostegus* (Mesopotamian catfish).

Economic importance. van den Eelaart (1954) gave the fishing season in Iraq for this species as December-February (peaking in January) and February and June-November (peaking in February and July-August). Sharma (1980) reported that this species was an important item at the Basrah, Iraq fish market, accounting for 68,948 kg from October 1975 to June 1977, although this is an order of magnitude less than for the three most important species.

Foreign soldiers in Iraq during 2005 regularly caught this species on angling gear using spoons and streamer flies, e.g., www.carpecapio.com, downloaded 26 August 2005.

Experimental studies. Velayatzadeh and Abdollahi (2011) found concentrations of lead, cadmium and mercury in the Karun River at Ahvaz were lower than international limits for these heavy metals.

Khuzestan, Karun River at Ahvaz White Bridge
(Iran – Ahvaz White bridge^ Karoon, CC BY 3.0, Alireza Javaheri).

Its potential for fish farming may be limited by its small gill area which makes it unfit to maintain gas exchange in oxygen-poor water (Salman *et al*., 1994). Kassim *et al*. (1998) found locally-raised *Scenedesmus acutus* algal cultures at $0.5*10^6$ cell/ml with baker's yeast at 0.05 g/l to be the best formula for raising the rotifer *Brachionus calcyflorus* as live food for larvae in Iraq. Growth rate was, however, higher on an artificial diet of boiled eggs and soybean meal at 52% compared to 48%, in contrast to common carp.

Conservation. Few specimens have been caught in Iran and deposited in museums. This may reflect inadequate collection methods. It was commonly caught by American soldiers in Iraq in 2004 as evidenced by emailed photographs sent to me for identification and is an important food fish in Iraq. Detailed surveys using appropriate equipment are needed to assess its distribution and status in Iran. Vulnerable in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Scale counts were taken also from Banister (1980).

Type material:- *Aspius vorax* (NMW 76785).

Iranian material:- CMNFI 1991-0147, 1, 276.3 mm standard length, Khuzestan, Hawr al Azim, Albogorbeh Village (no other locality data); CMNFI 1991-0154, 1, 133.0 mm standard length, Khuzestan, Hawr al Azim (ca. 31º45'N, ca. 47º55'E); ZMH 2516, 1, 259.9 mm standard length, Kermanshah, Karasu-Gamasiab-Seymarreh (= Qareh Su-Gamasiab-Simareh, no further locality data); not kept, 3, 105.6-282.5 mm standard length, Khuzestan, Hawr al Azim and Dez River (no further locality data).

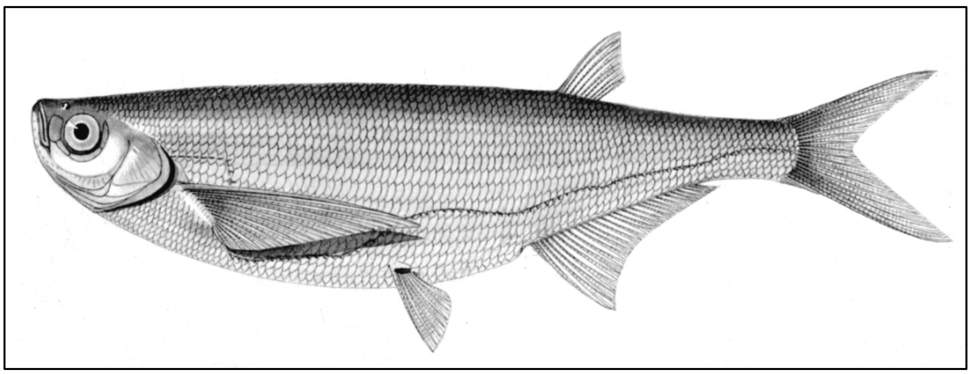
Comparative material:- BM(NH) 1920.3.3:127-146, 28, 69.8-284.7 mm standard length, Iraq, Basrah (30°30'N, 47°47'E); BM(NH) 1920.10.8:1, 1, 182.3 mm standard length, Iraq, Tigris River (no other locality data); BM(NH) 1931.12.21:11, 1, 250.2 mm standard length, Iraq, Mosul (36°20'N, 43°08'E); BM(NH) 1968.12.13:182, 1, 251.7 mm standard length, Syria, Cheria River,

tributary to the Orontes River (no other locality data); BM(NH) 1972.3.16:1, 1, 112.1 mm standard length, Iraq, Dokan Lake (no other locality data); BM(NH) 1973.5.21:189-190, 2, 166.2-192.0 mm standard length, Iraq, Shatt-al-Arab (no other locality data); CMNFI 1987-0117, 1, 200.8 mm standard length, Iraq, Hawr al Hammar (no other locality data); FMNH 51242, 1, 322.6 mm standard. length, Iraq, Halfaya east of Amara (31°49'N, 47°26'E); NMW 90366, 1, 309.0 mm standard length, Turkey, Cermik on the Euphrates River (39°09'N, 39°27'E); NMW 90807, 1, 214.8 mm standard length, Turkey, Devegeçidi Çayi, Tigris River basin (no other locality data); NMW 91020, 1, 170.6 mm standard length, Iraq, Shatt-al-Arab, Basrah (30°30'N, 47°47'E).

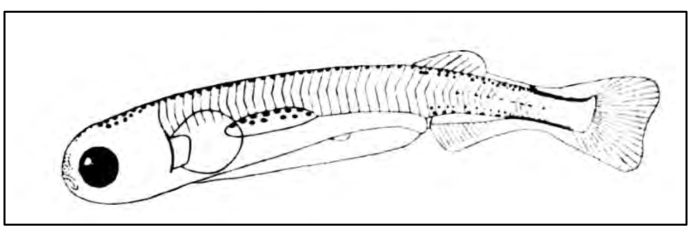
Genus *Pelecus*
Agassiz, 1835

The sabre carp genus contains only a single species found from the Baltic to the Black, Caspian and Aral Sea basins including Iran. This genus is the sister group to other Old World Leuciscinae (Schönhuth *et al*., 2018). The characters of the genus are the same as under the species.

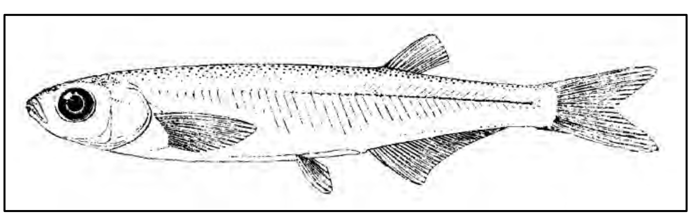
Pelecus cultratus
(Linnaeus, 1758)

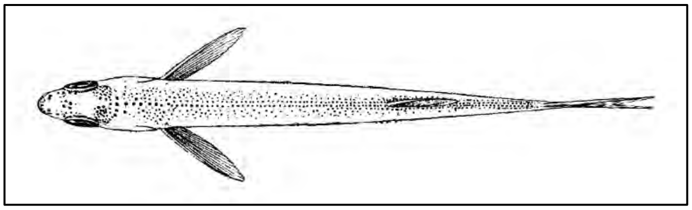


Pelecus cultratus, 27.3 cm total length, ZISP 13272,
Uzbekistan, Aral Sea near the mouths of the Amu Darya, after Berg (1948-1949).

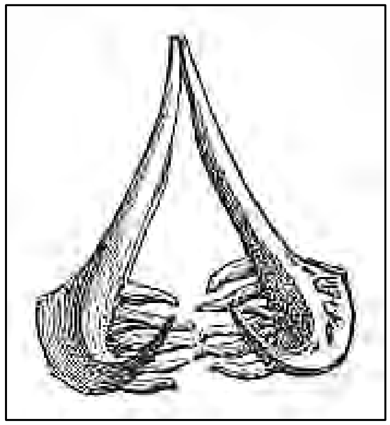


Pelecus cultratus fry, 14.2 mm,
Russia, Volga River delta, after Kazanskii (1925).

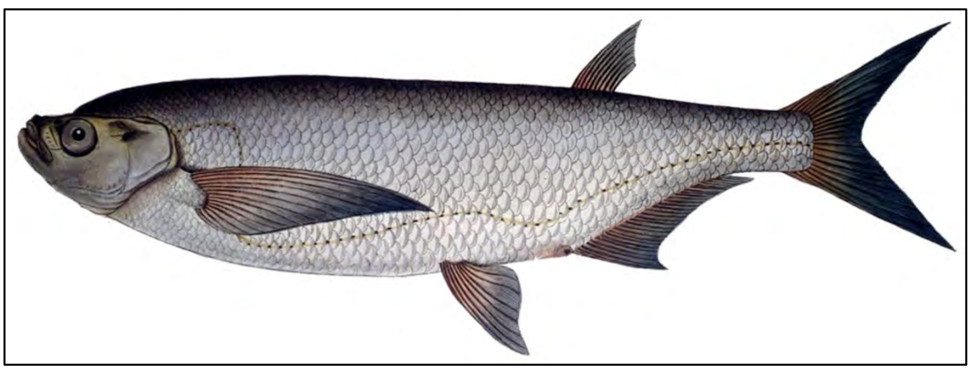




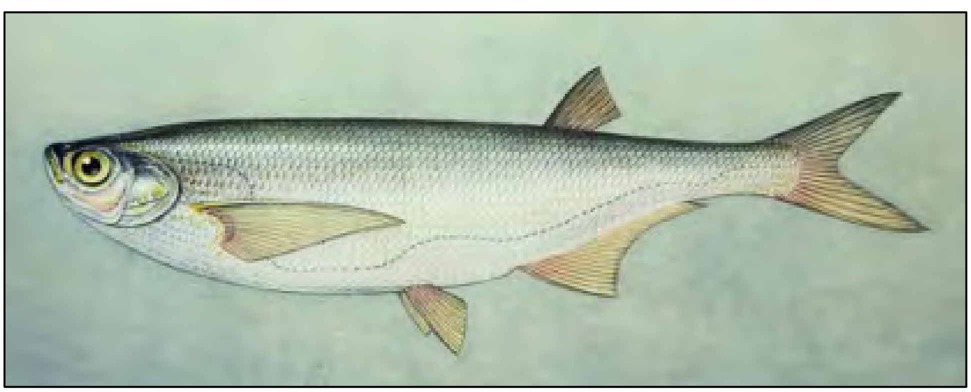
Pelecus cultratus young, 33 mm, lateral and dorsal views,
Kazakhstan, Ural River delta, after Shukolyukov (1932).



Pelecus cultratus, pharyngeal teeth,
after Seeley (1886).



Pelecus cultratus, after Bloch (1795-97).



Pelecus cultratus
(CC0, NOAA Photo Library, N. N. Kondakov).

Common names. Shamshir mahi (= scimitar or sword fish), shamshir mahi ab-e shirin (= freshwater sword fish), kuli.

[Gilincbalig in Azerbaijan; chekhon' in Russian; razorfish, sabre carp, sabrefish, sichel, ziege].

Systematics. *Cyprinus cultratus* was originally described from the Helgeån River, Sweden. The holotype is in ZMUU Linn. Coll. 224 and is in poor condition.

Pelecus cultratus kurensis Smirnov, 1943 is the Kura River basin subspecies but Berg (1948-1949) considered that other populations over the range of this species had been insufficiently studied to validate this subspecies.

Key characters. This species is easily recognised by the scaleless keel extending from the throat to the anal fin and the decurved and wavy lateral line.

Morphology. The body is elongate and strongly depressed. The dorsal profile including the head is straight. The ventral profile of the head rises sharply. The snout ends as part of the straight dorsal profile. Lips are thin. The caudal peduncle is compressed and moderately deep. The mouth is almost vertical. The large eye is in the anterior half of the head. The lower jaw is hooked in older specimens and has a tubercle which fits into an upper jaw notch. The dorsal fin is far posterior, lying over the anterior anal fin, is very small and has a straight or slightly concave margin. The caudal fin is deeply forked with pointed tips. The lower lobe of the caudal fin is larger than the upper, with more rays and a stiffer ventralmost ray. The long anal fin is very emarginate and does not reach back to the base of the caudal fin. The pelvic fins are rounded and almost reach back to the anal fin. The elongate anal fin is deeply emarginate. The pectoral fins are long and curved, used for rapid manoeuvring when swimming normally and folded against the body when swimming rapidly. They reach back to or fall short of the pelvic fins. Gill openings are very wide with the branchiostegal membranes attached far forward, under the eye level. Muscles on the back extend forward to reach the anterior eye margin. Scales end over the eye anteriorly on the head.

Dorsal fin unbranched rays 2-3, usually 3, followed by 6-10, usually 7, branched rays, anal fin unbranched rays 2-3, usually 3, and branched rays 23-31, pectoral fin branched rays 13-17, and pelvic fin branched rays 6-8. Lateral line scales 88-120. Scale shape is a vertical oval with rounded margins, the posterior margin almost vertical and the anterior margin more rounded, or is squarish with a shallow posterior margin, straight to rounded dorsal and ventral margins, abrupt and rounded anterior corners, and the anterior margin coming to a central point and somewhat wavy. Scales have extremely fine circuli, a central to subcentral posterior focus and very few posterior radii. Total gill rakers number 15-26 (reaching the second or third raker below when appressed). Pharyngeal teeth are 2,5-5,2, are narrow and are very strongly hooked at the tip with obviously serrate edges. Variants include 2,5-4,2, 2,4-5,2 and 2,5-5,3. The gut is an elongate s-shape. Total vertebrae number 46-52. The chromosome number is 2n = 50 (Klinkhardt *et al*., 1995; Arai, 2011).

Sexual dimorphism. Unknown.

Colour. The back is greenish and the flanks silvery to silvery-green. Fins are hyaline to grey, although the paired fins and the anal fin can be a bright yellow, and all fins can be quite dark.

Size. Reaches 65.0 cm and 2.0 kg, possibly 3.5 kg (Machacek (1983-2012), downloaded 27 July 2012) but most fish in the Volga-Caspian region are 80-180 g.

Distribution. This species is found in the drainages of the Baltic, Black, Caspian and Aral seas. In Iran, this species is reported as rare in the lower Sefid River (Derzhavin, 1934) and

is found in the Anzali Talab (Abbasi *et al*., 1999; Kiabi *et al*., 1999). Recorded by Abdoli (2000) from the middle to lower Sefid River, Anzali Talab and adjacent Caspian coast. Recorded from the Atrak River but not yet from its Iranian reach (Reshetnikov *et al*., 1997). Also reported from the Karakum Canal and Kopetdag Reservoir of Turkmenistan (Shakirova and Sukhanova, 1994; Sal'nikov, 1995) and so may eventually be found in the Tedzhen (= Hari) River basin of Iran.

Zoogeography. A European and Western Asian species with its origins in a Danubian or Sarmatian fauna.

Habitat. This species is found in rivers, lakes, dams and brackish environments. This species lives primarily in the sea but is also anadromous and may live permanently in larger tributaries. Naderi Jolodar and Abdoli (2004) noted two forms in Iran, one resident in fresh water and a migratory form. Generally, it inhabits surface waters, aided by fin and mouth modifications for this mode of life (Adamicka, 1984). It migrates to the fresh water of large rivers to spawn. In the sea and larger rivers, it occurs in schools.

Age and growth. Sexual maturity in the Volga River was attained at 3-4 years and a minimum length of 20.0 cm in males, 4-5 years and 22.0 cm for females. The largest immature males were 24.0 cm long, females 25.0 cm and the maximum age of non-spawners of both sexes did not exceed 6 years. The spawning stock was mostly fish 4-10 years old. Males had a slightly smaller maximum size than females and life span was at least 16 years (Sil'chenko, 1976). Spawning took place first at age 2 in the Kura River of Azerbaijan. Growth was faster than in other populations, the Kura fish being the same size at age 2 as age 3 fish from the Don River of the Black Sea and age 4 fish of the Aral Sea.

Food. Food is taken by the vertical mouth from surface waters and includes insects and spiders. Young fish feed on zooplankton and even adults will do this if crustaceans are abundant. In the sea, various crustaceans are taken and these may be pursued near the bottom. Full grown *Pelecus* (50-60 cm) will capture fish such as *Clupeonella* (kilkas, Clupeidae), gobies (Gobiidae), Cyprinidae and even sticklebacks (Gasterosteidae) (Adamicka, 1984).

Reproduction. Spawning took place in the latter half of May in the Kyubyshev Reservoir of the Volga River at 13.5-14.1°C or as high as 18-22°C. Water depths were 2.0-3.5 m. The main spawning took place around sunset over a period of 24 days with a peak period of 10-12 days. Fecundity reached 71,400 eggs. Eggs sank to the bottom but swelled to an average diameter of 4.7 mm within an hour of fertilisation. Once swollen, any slight movement of the water suspended the eggs in the water column. Eggs developed pelagically in floodplains, main rivers, side channels, bays and lakes but all these diverse habitats had a high oxygen content through flowing water or wind mixing. In the Volga flow rates were 0.28-1.1 m/sec on a sand-gravel bottom. Spawning may also take place in brackish water where the eggs float. Spawning in the Kura River of Azerbaijan took place at the end of April and in May. The larvae are phototropic and active swimmers.

Parasites and predators. The Caspian seal, *Pusa caspica*, was reported as a predator on this species (Krylov, 1984).

Economic importance. Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use in textbooks and for food. The scales contain silvery crystals of guanine which are extracted and used to make *essence d'orient* for artificial pearls. In the period 1909-1913, the catch in the Volga-Caspian region was more than 14 million fish annually. The flesh is fatty and bony and so this species is best smoked.

Experimental studies. None**.**

Conservation. Lelek (1987) classified this species as intermediate to rare in Europe but

fairly common in the Caspian Sea basin. Kiabi *et al*. (1999) considered this species to be critically endangered in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, few in numbers, habitat destruction, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Meristic values are based partly on Wais (1995).

Iranian material:- None.

Comparative material:- CMNFI 1971-0825, 1, 232.0 mm standard length, Czechoslovakia, Lake Ozirna (no other locality data); CMNFI 1987-0220, 2, 96.9-105.7 mm standard length, Rumania, Lake Călăraşi (44º20'N, 27º20'E); ZISP 13273, 1, 182. 6 mm standard length, Uzbekistan, Amu Darya, Petro-Alexandrovsk (= Turtkul) (no other locality data).

Genus *Rutilus*
Rafinesque, 1820

The roaches are found in Europe and Western Asia where there are about 15 species (Bogutskaya and Iliadou, 2006). Two to three species are found in Iran.

The genus is characterised by having pharyngeal teeth in one row, usually 6-5, more rarely 6-6 or 5-5, with conical crowns on the anterior teeth and posterior teeth slightly hooked and truncated, scales are large to moderate in size, numbering 33-68 and with numerous fine circuli and radii on all fields, few and short gill rakers (17 or less), short gut, usually a light peritoneum, few to moderate numbers of dorsal and anal fin rays (7-13), the dorsal fin commonly having 4-5 unbranched rays, abdomen behind the pelvic fins rounded or with a slight but scaled keel, and various osteological characters (Bogutskaya and Iliadou, 2006). Pourshabanan *et al*. (2017) confirmed the monophyly of this genus using data from an analysis of the cytochrome oxidase subunit I.

Levin *et al*. (2017) examined *Rutilus* taxa from the eastern part of the genus range using cytochrome *b* sequences. They found three major clades, *R. frisii* (which includes *R. kutum*), *R. rutilus sensu stricto*, and a group of six Ponto-Caspian taxa including *R. caspicus* (now *R. lacustris*) and *R. rutilus lacustris* of relevance to Iran. The Ponto-Caspian clade could be a single species, *R. lacustris* by priority of description. Levin *et al*. (2017) recommended using nuclear DNA and rigorous morphological examination to confirm this suggestion. Both *R. rutilus s.s.* and *R. lacustris* occur in the Caspian Sea basin although Levin *et al*. (2017) examined no material from Iran, their *R. rutilus* material being from the Volga and Ural River basins and some of their nominal *R. caspicus* (now becoming *R. lacustris*) being from the Caspian Sea of Azerbaijan and the Araks (= Aras) and Kura rivers. It remains to be determined whether *R. rutilus s.s.* occurs in Iran, presumably as a resident and non-migratory species of Caspian basin fresh waters. Jouladeh-Roudbar *et al*. (2020) also stated its presence in Iran needed confirmation. Data on Iranian *Rutilus*, appearing under the species names of *caspicus* and *rutilus*, are here treated under *R. lacustris* while recognising that resident populations may be that species too, or *R. rutilus* or indeed an undescribed taxon. Levin *et al*. (2017) noted the absence of phenotypic differentiation between under-yearlings of migrated and resident forms and that form-specific characters of the migrating fish previously identified as *R. caspicus* developed during their sea life. There was a lack of genetic divergence in cytochrome *b* from migrating and resident populations in the Caspian Sea basin, arguing for an ecological origin. This has not been tested thoroughly with Iranian populations.

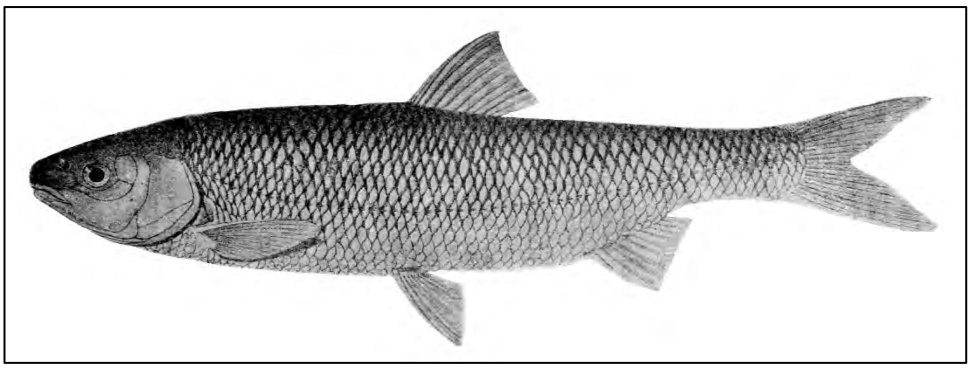
Chakmehdouz Gasemi and Behmanesh (2015) compared the two *Rutilus* species in the

south Caspian Sea of Iran (given as *Rutilus frisii kutum* and *R. r. caspicus*) using cytochrome *b* and found high genetic diversity and no distinct sister-clade. Eagderi *et al*. (2017) used osteology to compare fish from the Aras and Shalman rivers and Bandar-e Torkeman, finding differences in the Aras population from the other two may be due to phenotypic plasticity and, since similarities were observed between *R. rutilus* and *R. caspicus* (= *R. lacustris*) from the Kura (*sic*), it was proposed that they belong to the same species. *R. caspicus* from Torkeman may be a distinct taxon but this observation in particular needs additional evidence from DNA to be accepted.

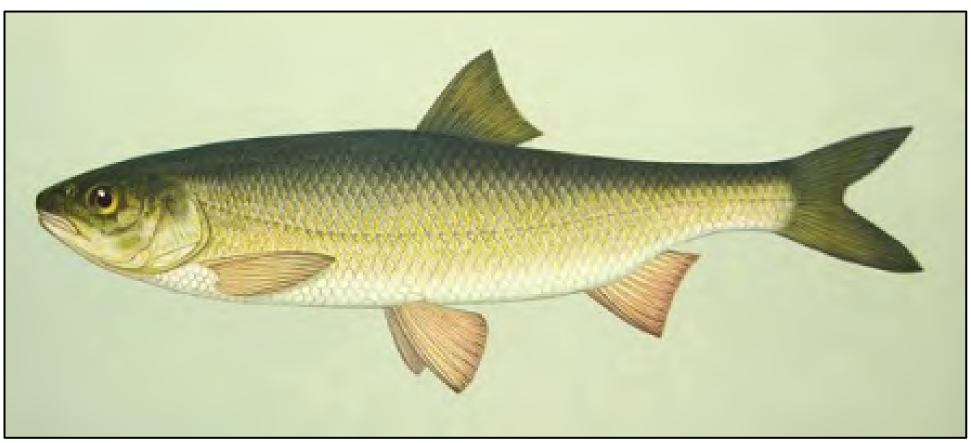
The following table summarises some key distinguishing characters of the Iranian species of *Rutilus*.

Species/Characters	Lateral line scales	Gas bladder	Distribution
R. kutum	47-68 (mostly 55-58)	Elongate and conical, or pointed, posteriorly	Caspian Sea
R. lacustris	39-48 (mostly 41-47)	Rounded posteriorly	Caspian Sea

Rutilus kutum
(Kamensky, 1901)



Rutilus kutum, western coast of the Caspian Sea, after Berg (1932b).



Rutilus kutum
(CC0, NOAA Photo Library, N. N. Kondakov).

Rutilus kutum, Gilan, Pol-e Rud, February 2005, Keyvan Abbasi.

Rutilus kutum, Iran, Caspian Sea, Vadim D. Vladykov.

Rutilus kutum, Iran, southwest Caspian Sea, Gh. Moradinasab and M. Daliri.

Common names. Mahi sefid or sefid mahi (= white fish, and occasionally cause for confusion in translation from the Farsi to English with the whitefishes of the family Salmonidae, not native to Iran), sifid mahyi and asbalan mahi (in Gilaki meaning white fish and fish with eggs or caviar), mahi sefid daryacheh khazar or mahisephid-e-daryaye khazar (= Khazar or Caspian Sea white fish), talaji (in Mazanderani), kutum (from the Russian name).

[Kutum, ak-balyk (meaning white fish) or ziyad in Azerbaijan; akbalyk or kutum in Turkmenian; kutum in Russian; Caspian kutum, pearl roach, Southern Caspian roach].

Systematics. *Leuciscus Frisii* was originally described from the market in Odessa and the Danube, Dniester, South Bug, Dnieper and Don rivers, draining to the Black Sea. *Rutilus frisii kutum* (Kamensky, 1901) was the generally accepted Caspian Sea basin subspecies although J. Holčík (pers. comm., 1994) considered that this was not a good taxon (see also Holčík and Jedlička, 1994). It was originally described as *Leuciscus Frisii* var. *kutum* from the Caspian Sea, essentially in the southern part, spawning in the rivers and streams of Transcaucasia and Persia (Kura, Araxes, streams of the Lenkoran district) and in lesser numbers elsewhere. No types are known. The *Catalog of Fishes* (downloaded 4 August 2020) has Kamensky's plate 12 as an illustration of this taxon but this is *Leuciscus frisii*.

The subspecies *R. frisii kutum* was distinguished from the type subspecies from the Black Sea by having fewer lateral line scales (about 55-58 versus about 60-66), shallower body (depth equal to or less than head length versus exceeding head length), anal fin longer than high versus shorter than high, lower lobe of caudal fin usually shorter than head versus longer (young *R. f. kutum* have this lobe as long as head), and dorsal fin as high as long versus higher than long (young *R. f. kutum* have dorsal fin higher than long). Kotlík *et al*. (2008) discussed divergence and gene flow between Black and Caspian Sea populations, the majority of the migrations occurring during the Pleistocene (ca. 10,000-1,800,000 years ago). The refugial populations in the Black and Caspian seas have diverged despite periods of migrations between them. Naseka and Bogutskaya (2009) concurred with this conclusion.

Leuciscus frisii caspius Lönnberg, 1900 described "from the Volga delta" has priority over *Rutilus frisii kutum* which may be a nomen nudum as it is listed in Radde (1899) as "*Leuciscus Frisii* Nordm. var. *Kutum* Kam." without a description, the description only appearing in Kamensky (1899-1901). However, the name *caspius* has not been used while *kutum* appears widely in the literature as well as being the common Russian name of the fish, also used in Iran. Kottelat (1997) considered *kutum* to be a distinct species as did Bogutskaya and Iliadou (2006) and Fricke *et al*. (2007). Kuljanishvili *et al*. (2020) noted their unpublished molecular data (COI) failed to distinguish the Caspian *R. kutum* from the Black Sea *R. frisii* and treated *R. kutum* as a junior synonym of *R. frisii*. *R. kutum* is now widely used for the Caspian Sea populations and I have left it as such until published data become available.

Leuciscus friesii Kessler, 1870 from the Volga delta is presumably a misspelling.

Chakmehdouz Ghasemi *et al*. (2009) found the spring and autumn races of this species to be independent populations using microsatellite markers. Chakmedouz Ghasemi *et al*. (2014) also used microsatellite markers to examine populations from the Anzali Talab and Shirud, two important spawning areas, finding the populations to be distinct. Kavan *et al*. (2009) investigated the population genetic structure of Iranian and Azerbaijani fish using microsatellite markers. Most of the variation was within rather than between locations.

Rezaei *et al*. (2010a) used microsatellite markers for fish from the Gorgan and Cheshmeh Kileh (= Tonekabon) rivers and found low genetic differentiation, which they attributed to mis-management of the restocking programme. Rezaei *et al*. (2010b), however, used microsatellite

markers for fish from the Gorgan and Qareh Su rivers and found a high level of genetic variation and more than one population in these Golestan Province waters. Rezaei *et al*. (2011) studied populations from the Gharesou (= Qareh Su), Tajan and Goharbaran rivers using microsatellite markers and found weak genetic differentiation between populations and a large amount of total variation within populations. It was suspected that natural divergence between riverine populations had been reduced by offspring transfer in stocking operations. Rezaei *et al*. (2013) investigated the microsatellite diversity and population genetic structure of fish from the Tajan and Tonekabon regions finding evidence of a genetic bottleneck because of a reduction in population size. There was no obvious genetic differentiation between the populations and gene flow was high.

Rezvani Gilkolaei (2011) used microsatellite markers for 210 specimens of kutum from the Gorgan, Khoshk and Tonekabon rivers, the Anzali Lagoon or Talab and the Kura River mouth of Azerbaijan and found the average of expected and observed heterozygosity was 0.54 and 0.49, respectively. Significant deviations from Hardy-Weinberg expectations were observed in almost all locations and there were significant differences between locations. Rezvani Gilkolaei *et al*. (2012) used microsatellite markers to investigate the spring- and autumn-run fish in the Anzali Lagoon and spring-run fish from the Khoshk River. The latter showed lower allelic and genetic variation. There was no significant difference between the two runs in the Lagoon suggesting they originated from a common ancestor.

Abdolhay *et al*. (2010) found independent populations existed in the Lemir (= Lomir), Sefid, Shirud and Tajan rivers based on morphometric data. This had implications for the extensive stocking programmes for this species. Abdolhay (2011) and Abdolhay *et al*. (2012), however, used mitochondrial DNA and found low genetic variability with two main clusters, Shirud and Lamir (= Lomir) River populations and Tajan and Sefid River populations, the clustering not conforming with geography. And, Abdolhay *et al*. (2012), using microsatellite DNA found populations to cluster in three groups, Shirud, Lamir (= Lomir) and Tajan-Sefid, again attributing low genetic variability and high inbreeding to artificial fingerling production.

Shojaei Kavan (2010) used biometry and microsatellite techniques to compare Azerbaijan, Gorgan, Khoshk, Tonekabon, spring Anzali and autumn Anzali lagoon populations, finding the highest genetic distance between Gorgan and autumn Anzali populations and the lowest between Gorgan and Tonekabon ones. There were at least two populations in the Caspian Sea and more than one in the southern Caspian with implications for artificial reproduction and stock rebuilding. Kolangi Miandareh *et al*. (2015) found a low genetic distance between fish from the Gharesu (= Qareh Su), Goharbaran, Gorgan, Sefid and Tajan rivers using cytochrome *b*, and the most haplotypes were found in Gharesu and Gorgan River samples. Laloei et al. (2016) found genetic diversity using microsatellite DNA was significantly different between samples of Golestan and Gilan, Golestan and Sefid River, Golestan and Tajan, Mazandaran and Sefid River and Gilan and Tajan. Safari (2016) collected fish from the coastline at the Cheshmeh Kileh (= Tonekabon), Gharasou (= Qareh Su) and Sefid rivers to examine the population structure using microsatellite markers. The average genetic variation was lower than most other anadromous fish and, in spite of migrations between the Cheshmeh Kileh and Qareh Su, there were three different populations with implications for management and restocking. Kashiri *et al*. (2017, 2018) collected fish from the Gomishan Wetland, Gorgan Bay, and the Gorgan and Qareh Su rivers, used microsatellite marker analysis to compare wild and hatchery populations and found a somewhat lower genetic diversity in hatchery fish, and this again has relevance to stock management.

Mazandaran, Tonekabon River at Tonekabon
(File 92 …. in Farsi, CC BY-SA 3.0, cropped, Mohammed Reza Shamsi).

Gorjian Arabi *et al*. (2010) analysed fish from the Shazdeh and Shirud using nine meristic characters and 26 morphometric characters. Principal components analysis showed both meristic and morphometric characters of females, but only meristic characters of males, overlapped. Kashefi *et al*. (2012) used meristic and morphometric characters to examine variation between non-reproductive and reproductive females in the southwest Caspian Sea. Meristic characters showed no difference but maximum body height, “post back” distance, dorsal fin height and upper caudal fin length discriminated between the two types. The first character could be indicative of eggs distorting the body profile. Ghojoghi *et al*. (2014) examined the morphometrics of fish from Bandar-e Torkeman, Mahmoudabad, Kelarabad, Bandar-e Kiashahr and the Talesh coasts, the populations clustering into three groups - Talesh (anterior position of caudal and anal fins), Kelarabad (elongate anal fin base), and the rest. Ghojoghi *et al*. (2018), examining fish morphometrically from the same localities as above, found the Kiashahr and Torkeman samples clustered together and concluded that kutum has a wide phenotypic plasticity potential.

Turkmen and Astara stocks could be discriminated using trace element content in otoliths (*Iranian Fisheries Research Organisation Newsletter*, 64:4, 2011). Tahami and Ghiasi (2013) compared serum markers and protein bioassay as well as morphometrics of fish from the Tajan and Shirud rivers finding significant differences in spring but not in autumn. Tahami (2014) found significant morphometric and blood serum (transferrin) differences between the two populations from the Shirud and Tajan rivers in spring, but not autumn.

Berenjkar *et al*. (2016) identified and sequenced the two copies of the growth hormone (GH-1 and GH-2) that are found in fish as a result of duplication during evolution. These sequences could be used to reconstruct phylogenetic relationships, study different allelic forms more precisely, and establish relationships between these loci and important economic traits.

Pourang *et al*. (2018) sampled fish from areas adjacent to the estuaries of the Gorgan Sefid and Tajan rivers and, using elemental fingerprinting of strontium in otoliths and potassium in scales, concluded that the Gorgan and Tajan specimens were from the same population.

Abbasi *et al*. (2020) sampled fish from beach seines for the shape indices of their sagittal otoliths and found four distinct spatial groups 1) Gomishan, 2) Khajeh Nafas-Miyankaleh-Sari-Babolsar, 3) Nowshahr-Tonekabon-Roodsar, and 4) Bandar-e Anzali-Astara.

A hybrid of this species and *Ctenopharyngodon idella* has been bred at the Astaneh Ashrafie Fisheries Research Station (Sefidrud Research Station) and named “Samur” (*Iranian Fisheries Research and Training Organization Newsletter, Tehran*, 11:6, 1996, 18:6, 1997; Khara *et al*., 2002; Nouruz Fashkhami *et al*., 2002). Gynogenesis may have occurred. Artificial hybrids with *Rutilus rutilus* (possibly including *R. lacustris*) and *Abramis brama* have been bred in Iran (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, pp. 39-40, 1996).

Key characters. This species is distinguished from the related *Rutilus rutilus* and *R. lacustris* by the higher scale count (usually >50) and the posterior part of the gas bladder being elongate and conical or pointed rather than rounded.

Morphology. The body is compressed and is moderately deep, being deepest between the end of the pectoral fin and the origin of the pelvic fin. The predorsal profile is almost straight, being slightly convex. The caudal peduncle is compressed and moderately deep. The head tapers to a rounded snout. The eye is at the beginning of the anterior half of the head. The mouth is oblique and extends back to the rear of the nostril level or almost to the eye. Lips are of moderate thickness. The dorsal fin margin is slightly to moderately emarginate. The dorsal fin origin is just posterior to, or over, the level of the pelvic fin origin. The depressed dorsal fin does not reach back to the level of the anal fin origin. The caudal fin is moderately to deeply forked with pointed tips. The anal fin margin is straight to slightly emarginate. The pelvic fin is rounded and does not extend back to the anal fin origin. The pectoral fin is rounded and does not extend back to the pelvic fin origin.

Dorsal fin with 3 unbranched and 8-10, usually 9, branched rays, anal fin with 3 unbranched and 9-12, usually 10, branched rays, pectoral fin branched rays 16-19, and pelvic branched rays 8-9. Lateral line scales 47-68, mostly 55-58. Scales are regularly arranged over the body. A pelvic axillary scale is present. Scales are oval in shape (but specimens examined were small). The posterior scale margin is rounded to crenulate and the anterior margin is wavy to crenulate or with a central protrusion but scale margins vary greatly between individual scales. The ventral margin is more rounded than the dorsal margin. The anterior scale corners are abrupt but rounded. Esmaeili and Gholami (2011) gave details of scale morphology using scanning electron microscopy, indicating that fine structures are of taxonomic import. Scales have numerous circuli, numerous posterior radii, few but distinctively crowded anterior radii (more than in *Rutilus rutilus* and *R. lacustris*) and an almost central focus which is broken up into a network of lines. Total gill rakers number 7-12 and are very short, hardly reaching the one below when appressed. Pharyngeal teeth are usually 6-5, with crowns rounded above a slender stalk, posterior teeth with a weakly hooked tip, and the posteriormost tooth margin may be serrated. The gut is an elongate s-shape. Total vertebrae number 40-44. Chromosome number 2n = 50 (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, p. 43, 1996; Klinkhardt *et al*., 1995; Noruz Fashkhani and Khosroshahi, 1995; Arai, 2011).

Adibmoradi and Sheibani (2002) carried out a histological study of the brain of this species and concluded, in part, that vision was sharp and the fish were good chasers of food. Naserizadeh *et al*. (2013) documented abnormal specimens from the Cheshmeh Kileh (= Tonekabon) River. Khoshnood (2015) described the histological structure of the visual system in larvae and fingerlings. Farhang and Eagderi (2019) described the ontogeny of the caudal skeleton. Mazaheri Kouhanestani *et al*. (2020) gave a description of the larval stage from southeastern waters of the Caspian Sea. Shabanipour and Abbasi (2020) followed the ontogeny of the eye from pre-hatch to the end of the larval stage. Vakili *et al*. (2020) described the

morphological characteristics of otoliths of fish from Fereydun Kenar.

Meristic values for Iranian specimens are:- dorsal fin branched rays 8(1), 9(58) or 10(1), anal fin branched rays 9(24), 10(35), 11(-) or 12(1), pectoral fin branched rays 16(15), 17(30), 18(14) or 19(1), pelvic fin branched rays 8(49) or 9(11), lateral line scales 47(1), 48(-), 49(1), 50(1), 51(1), 52(7), 53(8), 54(6), 55(5), 56(11), 57(7), 58(7) or 59(5), total gill rakers 8(1), 9(21), 10(25) or 11(13), pharyngeal teeth 6-5(23), 5-5(1) or 5-4(1), and total vertebrae 40(1), 41(7), 42(34), 43(3) or 44(2).

Sexual dimorphism. Females are larger than males. The breeding tubercles are evident in males and may develop as early as the end of summer before the spring spawning season in the following year. Large tubercles are found on the top of the head above the eye level, behind the eye, between the eye and the mouth and on the snout as well as on upper flank scales (see photographs above). Tubercles are white in contrast to the dark head. Imanpour and Shirmohammadli (2008) found that fish from the Gorgan River showed correlations between increase in number of tubercles and total length, sperm volume, and gonad weight but not with sperm motility, spermatocrit, sperm density and gonadosomatic index. Tekeh and Imanpour (2009) in their spermatology study examined fish with more than 135 tubercles on the head. Pourkazemi and Razikazemi (2011) tried to differentiate sex using a PCR-RAPD technique but failed either due to these fish not having sex chromosomes or the sex genes are on different autosomal chromosomes.

Colour. Small specimens up to a year old are silvery on the flanks and belly and the back is steel-grey to pale brown or pale olive. In adults, back scales are circled with black and there is a strong contrast between the back and flank. The anterior part of each flank scale, particularly those of the lateral line, is darkly pigmented. Lateral line scales may have two dots, one above and one below the opening as in some *Alburnoides* spp. but not as pronounced. The sides of the head are silvery with some yellow and darker pigment, the latter particularly in front of the eye. Adults are a bright silvery on the flank. The belly is pearly-white. The iris is silvery, with some spots, and with a marked dark spot above. The dorsal and caudal fins have some grey and a faint orange tint while the pectoral, pelvic and anal fins are colourless to lightly pigmented with black. The pectoral fin may be orange.

Size. Attains 68.0 cm total length, fork length 63.5 cm and 4.3 kg (*Iranian Fisheries Research Organization Newsletter*, *Tehran*, 65:2, 2011). An earlier reported gave 66.0 cm body length and 4.065 kg in Iran (Farid-Pak, 1968). Ouseley (1819-1823) ate one almost 3 feet long (ca. 90 cm). In Iran during the 1950s, catches were 36.0-67.0 cm long (Farid-Pak, No date). Rabazanov *et al*. (2017, 2019) gave maximum sizes of 71.0 cm and 5.0 kg and for commercial catches typically 1.0-1.7 kg.

Distribution. This species is found in drainages of the Caspian Sea. It is absent from the northeastern Caspian Sea and the northern eastern coast and is found only sporadically in the mouths of the Volga and Ural rivers. In periods of high abundance, it enters these rivers. In Iran, it is found along the whole Caspian coast, entering almost all the rivers to spawn including the Aras, Asbuchin, Astara, Atrak, Babol, Behambar, Chaf, Chalus, Chalvand, Chamkhaleh, Chobas, Dinachal (= Denya Chal), Goharbaran, Golshan, Gorgan, Haraz, Harisak, Haviq, Jef, Kargan, Kazem, Kelarabad, Khalehsara, Khazar Abad, Khoshk, Kiarud, Larim, Lomir, Mahmoudabad, Masoleh, Masuleh-Rukhan, Mirud, Molahadi, Nahang, Nawarud, Nesa, Pir Bazar, Polrud (= Pol-e Rud), Qareh Su, Rasteh, Sardab, Sari, Sefid, Shafa, Shah, Shalman, Shazdeh, Sheikan, Shesh Deh, Shirud, Siah Darvishan, Sorkh, Sowsar, Tajan, Talar, Tirom, Tonekabon and Valiabad rivers, the Anzali and Astara talabs, Boojagh Kiashahr, Gomishan and Miankaleh wetlands, at

Bandar-e Kiashahr, Bandar-e Torkeman, Nowshahr, Gorgan Bay, the Mojgol Sibli area of Astara, off Goharbaran, and in the southeast, southwest and south-central Caspian Sea (Nedoshivin and Iljin, 1929; Kozhin, 1957; Holčík and Oláh, 1992; Riazi, 1996; Karimpour, 1998; Oryan *et al*., 1998; Abbasi *et al*., 1999, 2007, 2017, 2020; Kiabi *et al*., 1999; Abdoli, 2000; Nazari, 2002; Najar Lashgari *et al*., 2007; Banagar *et al*., 2008; Lasheidani *et al*., 2008; Khara *et al*., 2008; Najafipour *et al*., 2008; Abdoli and Naderi, 2009; Piri *et al*., 2009; Shafiei Sabet *et al*., 2009a; Gorjian Arabi *et al*., 2010; Nikoo *et al*., 2010, 2012; Esmaeili and Gholami, 2011; Abdolhay *et al*., 2012; Einollahi *et al*., 2012; Hosseinzadeh Safari *et al*., 2012; Keivany *et al*., 2012; Rashidi *et al*., 2012; Rezvani Gilkolaei *et al*., 2012; Naserizadeh *et al*., 2013; Farzadfar *et al*., 2014; Hassanpour *et al*., 2014; Bagheri *et al*., 2015; Kolangi Miandareh *et al*., 2015; Rowshan Tabari *et al*., 2015; Moradi Chafi *et al*., 2016, 2017; Afraei Bandpei *et al*., 2017; Naderi Jolodar *et al*., 2017; Pourasdi *et al*., 2017; Kouhestan Eskandari *et al*., 2018; Shahnazari *et al*., 2020; Abbasi *et al*., 2021).

Hoseini *et al*. (2015) recorded it from the fishing stations Jahan Nama, Shahid Beheshti, Karegar, Azadegan, Azadi Larim, Azadi, Koliver, Karfon, Shahed, Fereydun Kenar, Bishe Kola and Khoram Mahmoodabad, listed from east to west along the Caspian shore in Mazandaran.

It has been introduced to Khandaghlo Dam Reservoir in Zanjan Province in 2003, whether accidentally or deliberately is not known (Abdolmalaki *et al*., 2017) and also introduced to the Gheshlagh (= Qeshlaq) Dam in the Tigris River basin of Kordestan Province (Bahrami Kamangar *et al*., 2012a; Zadmajid *et al*., 2017).

It is also found in Valasht Lake, Mazandaran (landlocked and introduced about 1850 to provide food for the royal family which had a summer residence there) where it possibly hybridises with native *Alburnus chalcoides* (Armantrout, 1980).

Mazandaran, Valasht Lake
(CC BY 3.0, Alirzea Javaheri).

Taheri *et al*. (2014) noted that this species is reared in earthen ponds in Qom Province. von den Driesch and Dockner (2002) recorded it as faunal remains in an excavation at the Great Mosque in medieval Siraf on the Persian Gulf coast. This may well be a misidentification but, if not, indicates that a fondness for this species has a long history considering that a preserved fish or its remains had to be transported all the way from the Caspian Sea.

Zoogeography. A species with its origins in a Danubian or Sarmatian fauna.

Habitat. This species is found in rivers, streams, dams, marshes and brackish environments. Some fish were reported at depths of 36.6-53.0 m in the Iranian Caspian Sea (Knipovich, 1921). It has been caught at 31-32°C in the Sefid River estuary on 9 July 1962 (CMNFI 1970-0565, CMNFI 1980-0908). It is migratory, spawning in rivers in March-April and returning to the Caspian Sea. Fish may spend 1 or 2 years in fresh water after hatching (Holčík and Oláh, 1992) and this affected growth, 1-year fish growing more quickly than those spending 2 years in fresh water, maturing earlier and having a shorter lifespan. Growth in the Anzali Talab was slower than it was 20 years prior to the report of Holčík and Oláh (1992), probably owing to a higher population density and more competition for food resources. Rezavi (1997) found three populations in Iran, one autumn and two spring populations. However, today the autumn run comprises only about 1% of the run as re-stocking is of the spring run (Rezvani Gilkolaei *et al*., 2012). Iljin (1927) recorded schools of fish entering the Anzali Bay (= Talab) as numbering in the several tens of thousands. On one fishing ground next to the Djifrud in February 1914, 12,000 fish were taken simultaneously. However, while the majority of fish migrated into lowland rivers not far from the sea to spawn among bulrushes and cattails, some migrated far upstream into the mountains of Tavalesh (= Talesh) and Gilan where spawning conditions were very different. These fish may well overwinter in the river (Derzhavin, 1934). Such fish reached altitudes of about 1,000 m before environmental changes inhibited the migration. Young fish migrated downstream, the migration ending in August, and in Azerbaijan entered the sea within 20-50 days. Holčík (1994, 1995) stated that Iranian young from the Anzali Talab never entered the sea but remained in fresh or brackish water for 1-2 years. Riazi (1996) reported that this species migrated into the Siahkeshim Protected Region of the Anzali Talab.

Yousefian (2011d) investigated the spawning migration in the Shirud, the most important river for wild production in Iran. The number of migrants was related to water temperature (see below), weather (clouds increased catch, wind from sea to land increased catch), the delta of the river (storms changing river direction decreased catch), water level (higher increased catch), turbidity (higher decreased catch), and sea wave conditions (waves increased catch). There was an early run when water temperatures increased slightly but quickly at the end of winter and a late run which held in sea areas near the river mouth for several weeks before migrating upriver. Migrating fish were caught at 7.0-19.5°C from early March to late May, with most taken at 10-14°C. About 30,000 males and 10,000 females migrated in 2003. Artificially propagated females made up 58.4% of the catch. Fish were 3-8 years old, males were 33.9 cm and 617.6 g on average and females were 39.6 cm and 975.5 g. Kouhi-Dehkordi and Bani (2017) sampled 4,567 adult fish ascending the Khoshk River between March and May 2012. Melatonin levels were measured in a hundred migratory spawners collected during the day and night. More fish entered the river at night. Melatonin levels decreased to the minimum level during peak days of migration, suggesting variations in melatonin levels could help to harmonize the daily rhythm in kutum migration.

Kohestan-Eskandari *et al*. (2014) caught 504 reproductive adults from four localities along the southern Caspian Sea and examined their morphometry. Each sample site represented

an independent population despite artificial stocking programmes over the last 30 years mixing brooodstocks. The results confirmed the success of homeward migration, the high grouping of fish suggesting that almost all populations returned to their birthplace river to breed, which resulted in high inbreeding.

Haghi Vayghan *et al*. (2013) used habitat suitability index modeling to determine that depth and substrate structure were the most important environmental variables for kutum to select its habitats and chlorophyll *a*, photosynthetically active radiation and sea surface temperature were the most critical parameters for near real-time prediction of habitat. Haghi Vayghan *et al*. (2016) modeled habitat preferences using classification trees and found the effect of different seasons, sea depth and photosynthetically active radiation were the main predictors affecting habitat preferences in the southern Caspian Sea. Ashtab *et al*. (2018) also used habitat species modelling and found depth and chlorophyll *a* were the most important environmental variables and the most suitable habitat was the southwestern Caspian Sea.

Fazli *et al*. (2014) investigated spatial and temporal distribution of this fish in bottom trawls from 10 to 100 m. The maximum catch and catch-per-unit-effort were 79.0 kg and 1.41 kg/0.5 h in spring. In spring and summer, most fish were in depths less than 20 m. The average catch-per-unit-effort was 94.0 kg/0.5 h in 20-50 m depths in autumn and 128.3 kg/0.5 h in depths greater than 50 m in winter. Bagheri *et al.* (2015) ranked rivers on physicochemistry at the time of release of cultured juveniles and found the Gorgan, Sefid and Tajan rivers were the most polluted and the Cheshmeh Kileh (= Tonekabon), Khalehsara and Khoshk were the best rivers. Bagheri *et al*. (2016) examined environmental factors of estuarine spawning sites and found no significant relationships between environmental changes over the period 1992-2012 and recruitment of kutum. Fazli *et al*. (2018) found that this species predominated, along with *Liza aurata* (= *Chelon auratus*, golden mullet), in the commercial beach seine fishery in the eastern part of the Caspian Sea at 73.05% and 24.67% respectively.

Abbasi *et al*. (2015) found that 1-2 g hatchery fingerlings, released in the Sefid River near Minoabad village about 2 km from the river mouth, almost all moved downriver to the mouth in 6 hours and the sea shore in 24 hours. Most migrated to the sea in the first month of release but some stayed in the river for 105 days, Fish were capable of osmoregulation allowing sea entry within a day. Moradi Chafi *et al*. (2017) examined larval production in two rivers in Gilan, finding in the Khalehsara River an estimated 7,250,000 larvae with an average body weight of 0.006 g and total length of 10.33 mm at first sampling and 1.38 g and 52.6 mm respectively at final sampling (April 13 to July 20, 2016). In the Khoshk River an estimated 3,050,000 larvae were 0.007 g and 11.32 mm at first sampling and 0.540 g and 38.09 mm respectively at final sampling. A decrease and increase in the estimated number of fry in the Khoshk and Khalehsara, respectively, was found compared to the previous year. In general, an estimated 10,300,000 fry were present in the rivers in 2016 and showed an increase of 5% over the previous year.

Afraei Bandpei *et al*. (2017) examined the complex relationship between this species and such biological parameters as phytoplankton, zooplankton and macrobenthos densities and the fish catch ratio of *Cyprinus carpio*, which was similar where this could be due to equal reproduction behaviours, feeding periods and anadromy.

Shahlapour *et al*. (2018) found juveniles of this species were dominant in the Farahbad region (68.1% relative abundance) and were dominant in the Miankaleh region but this was due to artificial breeding and release of juveniles. Naderi Jolodar *et al*. (2019) found this species comprised 73.05% of the total catch at Goharbaran, Mazandaran with *Liza aurata* (= *Chelon*

auratus, golden mullet) at 24.67%. Yahyaei *et al*. (2021) studied catches along the Miankaleh Peninsula from 1965 to 1993 comprising 8,914 specimens. The temperature factor, especially the increase in maximum temperature, had the most effect on the frequency of kutum.

Gerami (2016) recommended more studies on movement ethology of this species as an aid to making recruitment more successful.

Age and growth. Azari Takami *et al*. (1990) described the biology of this species in Iran. Males normally matured between their third and fourth year, sometimes earlier, females during their fourth year. Life span was at least 9 years in Dagestan (Shikhshabekov, 1979) and 8 years in Iran (Holčík and Oláh, 1992; Aghili and Mohammadi, 2012) and maximally about 12 years (Afraei Bandpei *et al*., 2010). Mohaghegh *et al*. (2014) aged Iranian fish using the sagittal otolith, finding fish 1^+ to 4^+ years. Spawners were 3-8 years old and the principal age groups were 4-5 years for males and 5-6 years for females in the Anzali Talab (Holčík and Oláh, 1992; Holčík, 1995), older than the 3-4 years of fish reported in 1970-1971. However, recently males were maturing at age 2 and females at age 4 with most spawners at age 3 and 4 years respectively (Holčík and Oláh, 1992). In Gorgan Bay 75% of the catch was 2-4 years old with four-year-olds at 31% weighing 790 g and length 38.7 cm on average (Aghili and Mohammadi, 2012). The average size of mature females (700 g) has decreased (Bartley and Rana, 1998b). Males grew faster than females until about the third year of life and then more slowly. Males were smaller and had a shorter life span than females (Holčík and Oláh, 1992). An annual increase in length of 17% over the first 4 years was observed in tagged fish, decreasing to 4.7% annually in subsequent years (for weight the figures were 61.2% and 25.7%). Male:female sex ratios in spring were 3.08:1 and in autumn 0.78:1 (*Annual Report, 1995-1996, Iranian Fisheries Research and Training Organization, Tehran*, p. 55, 1997).

A series of studies on this species, apparently sampling in somewhat different areas or from different commercial fish catches gave several growth parameters as follows, listed chronologically by author(s) and publication dates.

Abdolmalaki and Ghaninejad (2007a) examined the commercial catch in 2003-2004 and found mean fork length was 36.7 cm (range 21-69 cm) and mean age was 3.82 years (range 1-8 years). Age groups 3-5 years comprised 87% of the total catch age composition. von Bertalanffy growth parameters were L_∞ = 70.1 cm, K = 0.138/year, t_0 = -1.557 years, total mortality = 1.1/year, natural mortality 0.28/year and fishing mortality 0.83/year. Abdolmalaki *et al*. (2007) sampling the commercial catch found the total catch of kutum, including poaching, was 6,612.5 t or 43.3% of all commercial bony fishes in the 2004-2005 season. Mean fork length was 38.2 cm, age range was 1-8 years and mean age was 4.2 years. Age groups 3-5 years made up 85.5% of the age composition. von Bertalanffy growth parameters were L_∞ = 60.7, K = 0.15/year, and t_0 = -1.75 years. Instantaneous total mortality coefficient (Z) was estimated at 0.88/year, instantaneous natural mortality coefficient (M) was 0.31/year, and annual fishing mortality coefficient (F) was 0.52/year. Growth rate decreased in comparison to previous years probably due to non-selective artificial breeding over more than 20 years.

Najar Lashgari *et al*. (2007) found males migrating to the Khoshk River were 3^+ to 6^+ years old with an average weight of 122.5 g and an average standard length of 506.8 cm.

Patimar *et al*. (2007) examined fish migrating to the Tonekabon River and found males in age groups 3^+ to 6^+ and females in 4^+ to 7^+, age groups 3^+ dominated in males and 7^+ in females, sex ratio was 1:1.33 in favour of males, condition factor was highest in 6^+ males and in 7^+ females, growth was positive allometric for females and negative allometric for males, and von Bertalanffy growth parameters were L_∞ = 130.62 cm, K = 0.06/year and t_0 = -0.21 for females

and L_∞ = 79.87 cm, K = 0.11/year and t_0 = -0.38 for males.

Afraei Bandpei *et al*. (2008) surveyed biological characteristics in samples from Iranian coastal waters. Average fish size was 11.73 cm fork length, range 8.9-29.0 cm, average weight was 22.74 g and range 8.8-321.2 g. Females were larger than males (12.27 cm and 32.26 g on average compared to 11.03 cm and17.07 g). The male:female sex ratio was 1.3:1. Overall condition factor was 1.23. Afraei Bandpei *et al*. (2010) also recorded features of fish from Iranian coastal waters but found a range in size of 21 to 58 cm and 148 to 2,450 g, average fish size was 39.0 cm fork length and 830.3 g for females and 38.2 cm and 719.1 g for males, sex ratio was 0.65:1 in favour of females, and condition factor varied from 1.2 to 1.3. The von Bertalanffy growth parameters were L_∞ = 63.00, K = 0.21/year, t_0 = -0.88 years for both sexes, L_∞ = 62.03, K = 0.21/year, t_0 = -0.80 years for females, and L_∞ = 54.52, K = 0.27/year, t_0 = -0.75 years, and the growth performance index was 2.89 for both sexes. Life span was 9 years in females and 8 years in males with a mean age of 3.99 years overall and four-year-old fish dominating in the sample. The length-weight relationship value *b* was 3.02 indicating growth was isometric. Growth was seen to be rapid in this southern Caspian Sea population, attributed to warm temperatures, available food resources and the brackish water environment. Historically, there has been a decrease in size of fish over three decades as length and weight used to be 67 cm and 7 kg. Afraei Bandpei *et al*. (2010), in another study, investigated the population dynamics in Iranian fish during the fishing season October to April, and found the von Bertalanffy growth parameters to be L_∞ = 59.85 cm fork length (FL), K = 0.27/year, C = 0.25, WP (winter point) = 0.40, instantaneous total mortality coefficient (Z) was estimated at 1.28/year, instantaneous natural mortality coefficient (M) was 0.46/year, instantaneous fishing mortality coefficient (F) was 0.82/year, current exploitation rate (E) was 0.64, mean length at first capture (L_c) was 36.8 cm FL, maximum exploitation rate (E_{max}) was 0.76, and the current exploitation rate (E) was less than E_{max}. The highest growth oscillation occurred in December and was attributed to active feeding before wintering and migration to deeper waters. These figures indicated that the fish population was moderately exploited and agreed in general with other studies in the Caspian Sea. Variations in growth performance could be due to food availability, ecological conditions, geographical changes and genetic variability. A further analysis (Afraei Bandpei *et al*., 2011), also from October 2006 to April 2007 on fish from the beach seine fisheries, found von Bertalanffy parameters were L_∞ = 67.5 cm, K = 0.21/year (0.18 in one place in text) and t_0 = -0.10. The oldest females were 9 years old and the oldest males 7 years old. The highest frequency (52.6% for males and 35.5% for females) occurred at 4 years old. Mean fork length for males was 39 cm and for females 40 cm. Afraei Bandpei *et al*. (2013) found fish in Mazandaran waters of the Caspian Sea lived to 8 years and highest condition factors were in April at 1.29 and lowest in September at 1.16.

Daliri *et al*. (2010) sampled beach seine fisheries in Gilan from 2001-2010 and found catch-per-unit-effort had minimum and maximum values of 39.33 kg/n and 155.74 kg/n respectively.

Hoseini *et al*. (2010) sampled beach seine catches from Sari to Mahmodabad in Mazandaran finding most fish were age 4 years and growth parameters were L¥ = 58 cm, K = 0.24/year and t_0 = 0.016/year.

Fazli (2011) examined the fish catch in 2006-2010. Kutum, golden grey mullet (golden mullet, *Chelon auratus*) and common carp predominated the composition of bony fishes, representing 61.3, 29.6 and 7.6% of the total catch. The average fork length of kutum was 38.4 cm and weight was 784.5 g. The value of *b* in the length-weight relationship was 3.02 indicating

isometric growth. The maximum age was 12 years. The sex ratio showed that females were dominant. The von Bertalanffy growth equation was $L_t = 62.9\ (1-e^{(-0.19(t+1.0)})$.

Abedi *et al*. (2012) examined broodstock from the Tajan and Shirud rivers and juveniles from the Caspian Sea. Higher condition factors were noted for male compared to female broodstocks and female juveniles had a higher condition factor than males. von Bertalanffy growth parameters were $L_t = 50.11(1-e^{-0.48(t+1.814)})$ for broodstock from the Tajan, $L_t = 40.67(1-e^{-2.27(t-18.84)})$ for broodstock from the Shirud and $L_t = 48.36(1-e^{-0.537(t+0.913)})$ for juveniles. Males from the Shirud showed a negative allometric growth pattern, females from the Shirud and broodstock males from the Tajan showed isometric growth, broodstock females from the Tajan and juveniles of both sexes showed positive allometric growth.

Gheshlaghi *et al*. (2012) examined fish from the Beach Seine Cooperative along the Iranian shore and found a maximum fork length of 69 cm, weight 2,370 g, a life span of 14.25 years, a length-weight relationship of $W = 0.004L^{3.258}$, $L_\infty = 70.45$ cm, K = 0.2/year, $t_0 = -0.75$ years, total mortality = 0.92/year, natural mortality 0.36/year and fishing mortality 0.56/year. The exploitation rate was 0.6. The current yield per recruit was estimated as $YPR_{max} = 287.535$, meaning that if fishing mortality increased from 0.56/year to 0.7/year, the yield would only raise by 1.2%. Most kutum were caught before reaching the length of maturity. Maintaining the harvest at the current level would avoid overharvesting and allow a sustainable yield.

Gorjian Arabi *et al*. (2012) examined 100 males and 100 females from the Tajan River in March-May 2011 and found total lengths were 37.1-54.7 cm and weights 400-1,658.66 g, there were 5 age groups with most in age 3^+ and least in age 1^+ years in females and 2^+ and 6^+ in males, the instantaneous growth rate in 3^+-4^+ fish was much lower than younger age groups, the length-weight relationship was positively allometric for males ($W = 0.0000005xL^{3.47}$) and negatively allometric for females ($W = 0.00005xL^{2.73}$).

Keivany *et al*. (2012) studied predominately females in the Gorgan River estuary. There were six age groups up to 8^+ years with the 5^+ and 6^+ age groups dominant at about 75% of the catch. The male:female sex ratio was 1:1.5, significantly different. Growth was isometric (b = 2.93). The mean condition factor was 1.5 and was not correlated with age. This eastern population had a lower b value, a lower ratio of male:female, higher mean egg diameter and a lower absolute and relative fecundity (see below) compared to data on western populations, of import for fishing, stocking, and management.

Moradinasab *et al*. (2012) gave a b value of 2.9077 for 4,870 fish (20.5-62.5 cm total length) from beach seine fisheries of the southern Caspian Sea along with a mean condition factor of 1.017 and a relative weight of 0.929. Growth in this species had decreased in recent years, attributed to artificial breeding and restocking as well as overfishing and elimination of larger individuals.

Fazli *et al*. (2013) provided estimates of yield-per-recruit and spawning biomass-per-recruit under various harvest strategies for stock management purposes. The paper also proposed a method for estimating acceptable biological catch that accounted for differences in quality and quantity of data on this species. The current yield-per-recruit (with F (fishing mortality) = 0.61/yr and t_c = 3.2 yr) was 218.3 g per recruit which indicated that the fishery was operating below the maximum yield-per-recruit at 236.9 g when t_c = 3.5 yr. The yield-per-recruit was highest at F_{max} and $F_{0.1}$ when t_c = 4 yr (244.8 g and 214.2 g respectively). The $F_{30\%}$ value was 0.85/yr at t_c = 4 yr with the spawning biomass-per-recruit of 338.3 g. The $F_{current}$ (0.61/yr at current t_c is 3.2 yr) was higher than the corresponding reference points, $F_{0.1}$ (0.47/yr) and $F_{30\%}$ (0.46/yr). The acceptable biological catch was estimated at 7,850 mt in 2009-2010.

Mohammad Nejad Shamoushaki *et al*. (2013) analysed the catch from 1999 to 2008 in Golestan Province from 20 active seine cooperatives. The catch in the west (Miankaleh) was more significant than in the east (Gomishan), Catches declined over the period studied and the catch ratio was carp>mullet>kutum>roach at 39.23, 33.76, 26.54 and 0.47%.

Karimzadeh *et al*. (2014) examined samples from gillnet cooperatives in Tonekabon in the southwest Caspian Sea and found age groups 1-7 years with the 4-year age group the most frequent (51.1%) and the 1-year age group the least frequent (0.8%), and males were commoner than females.

Alaei Borujeni *et al*. (2015) found that the estimated maximum sustainable yield for the period 1989-2007 was higher than the reported yield by beach seine cooperatives. By controlling illegal fishing, beach seining could be raised at least 61%, maintaining sustainability. Alaei Borujeni *et al*. (2015) showed that the recruitment enhancement programme in place since 1982 had positive effects on profitability and a reduction in fishing mortality caused a consequent increase of the net present value from the fishing activity.

Kouhestan Eskandari *et al*. (2018) compared six models for back calculation (estimating growth in years preceding capture from fish lengths at previous ages derived from scale or otolith annuli), namely scale proportional hypothesis, body proportional hypothesis, nonlinear scale proportional hypothesis, nonlinear body proportional hypothesis, the Morita Matsuishi model and the Fraser Lee model. The Fraser Lee model was preferred for both males and females.

Daryanabard *et al*. (2019) collected data from fishing cooperatives in Gilan, Mazandaran and Golestan provinces. Mean fork length and total weight were 37.4 cm and 729.8 g, age range was 2 to 11 years with fish 3 to 4 years old comprising 73.4%, mean length of 3-year-old fish was 33.8 cm and of 4-year-old fish 39.0 cm, the *b* value in the length-weight relationship was 2.99, L_∞ was 61.4 cm, K was 0.21/year, t_0 was -0.54, mortality parameters Z, M and F were 0.76, 0.36 and 0.36 respectively, and the biomass was estimated at 27,437.7 tons.

Fazli *et al*. (2019) examined fish from the eastern coasts of the Caspian Sea (Goharbaran region) using three fishing methods, small mesh size beach seine, gillnet and commercial beach seine, during January 2014 to July 2014. The results showed that the slope (*b* value) of the length-weight relation was 3.0003 indicating isometric growth. Small and large fish were caught in the small mesh size beach seine and the commercial beach seine, respectively. The average length and weight were significantly different among three fishing methods. The average condition factor of small mesh size beach seine, gillnet and commercial beach seine were calculated as 1.30, 1.38 and 1.29 and K_{rel} was recorded as 1.30, 1.37 and 1.29, respectively. For both variables, there were significant differences among three fishing methods. Also, the averages for condition factor and relative condition factor were significantly different among the different length classes and seasons. Based on the average relative condition factor, it was concluded that this fish had good feeding and growth conditions in the Goharbaran region.

Forouhar Vajargah *et al*. (2020a) reported negative allometric growth for fish from Sari and Bandar-e Torkeman (*b* = 2.56 for 42 fish, 34.2-43 cm total length, and 2.72 for 44 fish, 35.2-41.5 cm) and positive allometric growth for fish from Anzali, Kiashahr and Astara stations (*b* = 3.03 for 44 fish, 16.5-51.0 cm, 3.1 for 44 fish, 29.0-50.0 cm, and 3.07 for 44 fish, 30.0-48.0 cm). Fish from Anzali had the maximum condition factor (1.152) and those from Astara the lowest (0.107), presumably from unsuitable nutrient conditions and pollution at the latter. Forouhar Vajargah *et al*. (2020b) examined 112 fish, 16.5-51.0 cm total length, from beach seines on the south Caspian Sea shore. The mean gonadosomatic and hepatosomatic indices for

the whole population were 4.67 and 7.86, respectively. The length-weight relationship in males, females and total population were $W = 0.821L^{2.4278}$, $W = 0.01L^{3.0025}$ and $W = 0.041L^{2.6224}$, respectively. A negative allometric growth pattern was shown for males and the whole population, whereas females followed an isometric growth pattern. The mean condition factor was 1.10 in males, 1.01 in females and 1.07 in the whole population. Differences between males and females in condition factor were not statistically significant.

Shahifar *et al*. (2020) studied growth and mortality parameters based on 700 samples collected from commercial beach seining in Gilan and Mazandaran provinces during the 2017-2018 fishing season. Females were dominant in both populations. Size frequency distributions showed significant variation among and between sexes. Different length-weight relationships were observed, positive allometric in Mazanderan (b = 3.03 and 3.15 for males and females) and negative allometric in Gilan (b = 2.66 and 2.95 for males and females). There were significant differences in growth parameters between sexes, females were of much greater asymptotic length than males, while the male fish had a higher growth rate and attained a smaller theoretical L_∞ size than females (L_∞ = 60.74 cm fork length for males and 69.12 for females from Gilan and 52.77 for males and 69.12 for females from Mazandaran). The theoretical maximum length (L_∞) was larger than the maximum one recorded during sampling. Based on the Bhattacharya method, the Caspian kutum from Gilan fishing grounds was more diverse, and included nine cohorts, while the population from Mazandaran Province showed only six cohorts. The linearised catch curve based on age composition data showed that total mortality rates (Z) were 1.32/year and 0.63/year for males and females of Gilan, and that of males in Mazanderan was 1.04/year and of females 0.86/year. The natural mortality rates (M) were 0.48/year for males and 0.26/year for females in Gilan, and 0.26/year and 0.45/year for males and females in Mazanderan. The exploitation ratio (E) was found to be higher than 0.5 for both sexes from Gilan, and was lower than the expected optimum level of exploitation in males and females caught in Mazandaran. Caspian kutum suffered greater fishing pressure in Gilan and fishing pressure was relatively low in Mazandaran. The relatively high degree of variability found in some growth parameters could represent either adaptations to local selective pressures (both fishery and environmental) or ecophenotypic variations. The estimated Caspian kutum population parameters indicated a trend toward its being a k-strategist species based on a high maximum theoretical length, a low growth rate, a long lifespan and a low natural mortality. This suggested that regulation strategies developed for fishery management should be based on the different growth patterns.

Food. Juveniles in the Anzali Talab of Iran fed mostly on phytoplankton in contrast to the zooplankton reported for Azerbaijan fish (Holčík, 1995). This was a consequence of the poor productivity of this lagoon. Fingerlings in the Sefid River estuary fed on 52 genera of phytoplankton, 15 groups (*sic*) of zooplankton and 10 groups of benthic animals (Abbasi *et al*., 2016). *Nitzschia*, *Navicula* and *Synedra* were abundant phytoplankton foods, Rotatoria, Rhizopoda and Cladocera were zooplankton foods, and chironomid larvae were benthic food. There were seasonal and spatial (river or sea) differences in food quantity and quality, with zooplankton and benthos the main food items. Small Iranian specimens from the Caspian Sea had bivalve shell remains, plant remains and in one case a worm, in guts of fish seen by me. In general, adults fed on molluscs, insect larvae and crustaceans.

Oryan *et al*. (1998) stated that the bivalve *Cardium* was the main food of this species on the eastern and western coasts of Bandar-e Anzali. Crabs and the barnacle *Balanus* were also important. The hepatosomatic index was highest in February and March, the prespawning period.

Seyfabadi *et al*. (2005) compared diet with mullets (*Liza* (= *Chelon*) spp.) on the

Mazandaran coast and found feeding priority was barnacles, bivalves and sand crabs for kutum and foraminifers, ostracods, bivalves and gastropods for mullets, and there was no feeding competition.

Afraei Bandpei *et al*. (2008) found diet in the southern Caspian Sea was the mussel *Mytilaster* (48.46%), Gastropoda (31.84%), the bivalve *Cerastoderma* (19.65%) and *Balanus* (0.05%). Afraei Bandpei *et al*. (2009) sampled fish from the commercial catch caught from October to April and found the diet was dominated by bivalves (59%) with *Cerastoderma lamarcki* the dominant prey (57%). Other foods were cirripeds (21%), gastropods (13%), malacostracans (3%), fish eggs (2%), amphipods (1%), and filamentous algae (1%). Fish fed on a wider variety of food groups in November compared to other months and the lowest feeding activity was in January and April, the latter being the peak of the spawning season. Afraei Bandpei *et al*. (2013) found fish in Mazandaran waters of the Caspian Sea fed on *Cerastoderma lamarcki* as the main prey, *Theodoxus* sp. (snail), and *Balanus improvisus* as subordinate prey, and *Rhithropanopeus harrisii* (crab), *Hypanis* sp., *Neogobius* sp., algae, scales and fish eggs as random prey. Fingerlings (<10 cm) fed on *Exuviella cordata* (= *Prorocentrum cordatum*, a dinoflagellate) and *Nitszchia distance* (*sic*, a diatom) and nematodes. Carnivory started at one year of age on mysids.

Fazli (2011) recorded the main prey item of mature fish in the southern Caspian Sea was *Cerastoderma lamarcki* while Gastropoda and *Balanus* were subordinate. Crabs, the bivalve *Hypanis*, fish (*Neogobius* sp.) algae, eggs and scales were random prey items. Planktonic groups comprised juvenile food including *Exuviaella*, *Nitzschia*, *Oscillatoria*, *Synedra*, Nematoda, *Navicolla* (*sic*, presumably *Navicula*), *Diatoma* and *Rhoicosphenia*. Based on the important species index, *Cerastoderma lamarcki* and *Balanus* were dominant species in the food.

Naderi Jolodar *et al*. (2013) also found *Cerastoderma* was the main food (by weight) with *Balanus* the main food by frequency. Feeding intensity was higher in males and in length groups smaller than 30 cm, and lower in the spawning season and winter. Bivalves had a pivotal role in feeding but had decreased in recent years.

Abdolmalaki *et al*. (2017) found the introduced population in Khandaghlo Dam Reservoir in Zanjan fed on the shrimp *Macrobrachium niponnense*.

Naderi Jolodar *et al*. (2019) found fish at Goharbaran, Mazandaran fed on bivalves predominately, especially *Cerastoderma*, while gastropods, crabs, fish eggs and filamentous algae were rare. The reduction in bivalve stocks was such that there was not enough food for kutum stocks.

The hybrid with *Ctenopharyngodon idella* fed principally on macrophytes with phytoplankton as a secondary food in ponds in Gilan (Khara *et al*., 2002).

Zarbalieva (1987) provided data on feeding of this species in the Caspian Sea off Azerbaijan. Fish concentrated on a sandy-shell rock bottom and remain there for most of the year to feed. The crab *Rhithropanopeus harrisii* dominated in the diet, 67.9-93.7% by weight. Molluscs, mainly *Cerastoderma lamarckii*, comprised 30% by weight of the food of fish 30-40 cm long. Fish larger than 40 cm seldom took molluscs but occasionally *Clupeonella* spp. (kilkas, Clupeidae). Molluscs used to be the main diet item of this fish. Stocks of kutum declined between 1991 and 2006 with a decline in kilka stocks themselves affected by competition for food with the invasive ctenophore *Mnemiopsis leidyi*. However, the decline in kutum catches seemed to be more related to overfishing than the ctenophore invasion (Roohi *et al*., 2010). Pourang *et al*. (2016) noted a sharp increase in kutum stocks between 2001 and 2006, attributed to adaptation to new conditions in relation to the invasive ctenophore.

Reproduction. Fish spawned annually according to an Iranian study by Azari Takami *et al*. (1990) and probably returned to their river of birth. Temperatures, and probably river flow, were the factors determining the entrance of fish into the rivers on the spawning migration. Male fish ran before females. Yousefian and Mosavi (2008) gave March to May as the spawning season. Aminian Fatideh *et al*. (2008, 2008) determined stages of sexual maturity of migrating fish, 87% achieving stage 5 in April and 94% stage 5 in June. Shafiei Sabet *et al*. (2009a) studied developmental changes in the ovaries of fish in the Bandar-e Kiashahr area of the southwest Caspian Sea. The gonadosomatic index began to increase in March, peaked in April and then decreased sharply in early May. Development was synchronous. The main migration (99%) in the Anzali Talab began in February and lasted 3 months at 8-10°C with a much smaller run (only about 1%) in November-December. The talab is now overgrown with reeds or has a silty, vegetated bottom and is no longer a spawning site (Holčík and Oláh, 1992), an economic and poetic loss. Holčík and Oláh (1992) translated Iljin (1927) on Anzali Talab mahi sefid "During this time the reeds rustle as if of wind as the fish rubs pushing their flanks to the reed stalks or pushing forward among reeds standing in rows". Each female was flanked by two males at spawning in shallow water. Sometimes the backs of the fish protruded from the water. Females sharply rubbed their lower abdomen and pectoral area on the gravel bottom, males and females convulsed, and eggs were shed and fertilised. Eggs are adhesive and hatch in 20 days at 10-14°C. The migration into the Dinachal (probably Denya Chal) River occurred on 1 November in 1975, when sexually immature fish were caught. By 11 February, five spawners were caught and the peak migration occurred on 26 March when 3,845 fish were caught at a water temperature of 10.5°C. The migration was continuous until 11 May. Water temperatures between 28 March and 23 April in 1976 and 1977 varied between 9.1°C and 13.5°C when peak migrations occurred in the Havyg (probably Haviq) River. Here, the spring form of this species started to migrate at 6°C and the optimum water temperature appeared to be between 11 and 13°C. Khaval (1998) reported a spawning migration into the Sefid River despite construction, sand removal and pollution. The migration peaked in the second half of March at a water temperature of 11°C. Golshahi and Moradnezhad (2009) captured migrating fish in the Goharbaran River, Mazandaran from 14 March to 21 April 2008. The temperature range at this time was 11-18°C. The male:female sex ratio was unequal at 1.82:1. Absolute and relative fecundities were 40,550 and 40,714 eggs (*sic*). Dehkordi and Bani (2016) counted 4,563 adults ascending the Khoshk River between 13 March and 9 May 2012. They found that more fish entered the river at night and that melatonin levels helped, as a secondary factor, in harmonizing the day-night rhythm of the migration. Melatonin is a hormone that regulates sleep and wakefulness.

Embryonic development in glass incubators at 14-16°C was described by Parivar *et al*. (1993). Cleavage and gastrulation began within 24-30 hours, hatching at 216 hours (10 days after fertilisation) and resorption of yolk was complete at day 16. Some males and females were injured through contact with the gravel stream bed. Embryonic development took 10-15 days at 8-16°C and 5-6 days at 20°C (Aslaanparviz, 1994). Young fish go down to the sea in summer according to some works although Holčík and Oláh (1992) believed that they stayed in fresh water or brackish river mouths for 1-2 years before entering the sea.

Abdurakhmanov (1962) gave a fecundity of 290,000 eggs for fish in Azerbaijan, higher than Iranian reports below. Farid-Pak (1968) examined 888 fish from the Murdab Bay (= Anzali Talab) where sexually mature females were 38-68 (68 in abstract, 66 in conclusions), mean 51.25 cm long, weighed 840-4,065, mean 2,181 g, weight of roe in stage 4 was 100-755, mean 360.7 g, absolute fertility was 36,200-198,560, mean 106,805 eggs, relative fertility was 22,300-

79,400, mean 49,200 eggs/g, and maximum egg diameter was 2.0 mm. There were two spawning migrations, winter and spring, and so two forms or stocks of this species (Azari Takami *et al*., 1990). There may be three stocks based on electrophoretic studies of blood proteins associated with the two spawning migrations (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, p. 41, 1996). The winter form entered rivers with emergent or submerged aquatic plants at the end of autumn or the beginning of winter. Eggs were deposited on these plants. The principal rivers were the Nahang Roga, Pir Bazar Roga, Sowsar Roga, and Anzali Roga (all draining the Anzali Talab) but the stock had declined with overfishing and destruction of the habitat. The Sefid River was listed as the main spawning ground by the Caspian Sea Biodiversity Database (www.caspianenvironment.org). The spring form entered rivers at the end of winter or the beginning of spring and spawned on gravel or sand. Adults returned downstream after spawning, in the early morning. The run occurred both by day and night but increasing water clarity near the end of the spawning season limited runs to the night.

Yousefian and Mosavi (2008) found a spawning temperature range of 5 to 21°C centred on 11°C. Fertilisation rate in four rivers was 75-92% and hatchability was high. Rivers with high turbidity had low hatchability because of egg damage. Further details of natural and artificial reproduction were given by these two authors.

Afraei Bandpei *et al*. (2011), for beach seine fishes, found reproduction occurred in March-April with the highest gonadosomatic index for males at 6.52 and for females at 17.0 in April. Fifty-percent of female fish were mature at a fork length of 37.78 cm. Absolute fecundity ranged from 15,723 eggs for a three-year-old to 130,737 eggs for an eight-year-old with a mean of 60,435 eggs. Males matured at age 2, females at age 3 years, with most spawners at age 3 years for males and age 4 years for females. A reduction in length at first maturity and a lower number of eggs was noted compared to other studies, perhaps due to sampling methodology.

Fazli (2011) recorded the spawning migration started in March in the southern Caspian Sea. The gonadosomatic index value peaked in March and April. Absolute fecundity was 64 400 eggs. Length at maturity (Lm50%) was 39.07 cm.

Khara *et al*. (2011) examined 90 females caught from the Shirud in February-May and found average values for total length of 43.26cm, weight 832.08 g, age 4.41 years, egg diameter 1.85 mm, egg number 294.49, absolute fecundity 41,370, relative fecundity 52 and fertilisation 93.55%. Khara *et al*. (2012) also reported on migrants to the Shirud River and found maximum average egg diameter (1.86 mm), number of eggs in each gramme of body weight (309.12), relative fecundity (56.21) and fertilisation rate (95.82%) was found from 5 to 20 April at 15.95°C, while maximum average of ovary weight (201.0 g) and absolute fecundity (49,987.18 eggs) was found from 6 to 20 March at 17.74°C.

Keivany *et al*. (2012), in their Gorgan River estuary population, found an absolute fecundity up to 115,177 eggs in an eight-year-old fish. Absolute and relative fecundities were 70,300 and 51/g eggs. Fecundity was highly and positively correlated with fork length, body weight, ovary weight and age. Egg diameters reached 251 μm. Gonadosomatic indices peaked in the last week of April.

Moradi Chafi *et al*. (2016) sampled rivers in Gilan from 29 April to 29 June 2015 and found an estimated 4,165,000 larvae in the Khale-Sara River with an average body weight 5.2 mg and total length 9.8 mm at first sampling and 51.8 mg and 17.9 mm by late May, and an estimated 5,640,000 larvae in the Khoshk River with an average body weight of 7.4 mg and total length 11.0 mm at first sampling and 509.8 mg and 35.7 mm by late June.

Bavand Savadkouhi and Khara (2017) investigated age-dependent (three- to six-year-old

fish) changes in reproductive efficiency in the Shirud, Mazandaran Province. No differences were found in sperm characteristics between age groups. Female characteristics showed change with the highest fertilisation rate (87%) and survival rate (91%) when four-year-old males were crossed with four-year-old females. Egg diameters ranged on average from 1.48 to 1.63 mm, absolute fecundity from 25,838.7 to 62,656.8 eggs and relative fecundity from 52.2 to 59.2 eggs/g. Ghomi *et al*. (2017) also examined fish from the Shirud and found that there was a significant negative correlation between the total length and weight of females and the number of larvae produced in a gramme. Total length and weight of adult males and females had no significant relationship with other reproductive parameters such as egg weight and size, fertilisation rate and larvae weight, so that such parameters were independent of broodstock size. Ghomi *et al*. (2017) examined the relationship between physico-chemical parameters and reproductive parameters in Shirud fish and found sea water salinity and egg weight were negatively correlated, river salinity was correlated with egg weight and fertilisation rate, and electrical conductivity and total dissolved solids were correlated with egg weight.

Zadmajid *et al*. (2017) examined 20 male fish from the Gheshlagh (= Qeshlaq) Dam, an introduced population in the Tigris River basin. The fish averaged 2.1 years of age, various sperm and seminal plasma parameters were recorded, the mean gonadosomatic index was 5.71 and there were no adverse effects on male reproductive characteristics in these transplanted fish.

Kousha *et al*. (2007) examined some aspects of reproductive endocrinology in this species, specifically on sex steroid-binding protein in plasma. Najafipour *et al*. (2008) examined 17-αhydroxy progesterone hormone levels, egg diameters and liver weight in fish caught at sea and in the Chalvand River near Astara. These factors were used to indicate physiological indices of reproduction, hormone levels and egg diameters increasing in fish caught in the river, while liver weight decreased. Egg diameters increased from 1.55 to 2.14 mm. Shafiei Sabet *et al*. (2009b) studied gonad steroid levels in fish from the Sefid River and found estradiol and testosterone reached their highest levels in April and were closely correlated to ovarian development and the gonadosomatic index. Heidari *et al*. (2009) gave microscopic details of oocyte development. Shafiei Sabet *et al*. (2010b, 2011b, 2011c) described ovarian follicle ultrastructure and the rhythm of gonad development in fish from Bandar-e Kiashahr, showing that the gonadosomatic index began to increase in March, was highest in April and decreased sharply in early May. Gonad development was synchronous. Darvish Bastami *et al*. (2013) found that the fatty acid composition of the ovule showed greater similarity to saltwater fish rather than species in fresh water despite this fish being a freshwater spawner. In addition, there were direct relationships between fatty acid composition and egg size, egg number and weight of larvae. Imanpour *et al*. (2013) examined ionic ratio variations in milt from fish captured in the second half of March, the migration season. Broodstock migrating to the Shirud had better semen quality than fish from the Tajan and Gorgan rivers. Abdollahi and Imanpur (2014) examined fish from the Tajan River and found egg diameters of 1.92-2.25 mm and a surface to volume ratio of 2.66-3.07 mm^{-1}. Hydrated eggs were 2.41-2.78 mm and 2.162.48 mm^{-1}. Diameter values were minimum at the end of the migratory time and maximum at its initiation, and the reverse for surface to volume ratio. Shafiei Sabet *et al*. (2016) collected fish from the Sefid River estuary and studied variations in plasma sex steroid hormones in females. A resting stage extended from June to February with the lowest levels of hormones and a peak reproduction activity phase in March and May. Progesterone was highest in March-April, testosterone in March-April and 17 β estradiolin February-May. Curiously, the baseline level of 17 β estradiol during the resting stage was high compared with other teleost fishes and the gonadosomatic index was also high. This

suggested either non-migratory populations in the Caspian Sea or populations which migrate to adjacent wetlands in autumn for spawning.

Parasites and predators. Mokhayer (1976b) recorded the digenetic trematodes *Aspidogaster limacoides* and *Asymphylodora macracetabulum* from kutum. Eslami and Kohneshahri (1978) reported various helminths from this species in Iranian waters. These were the monogenean *Diplozoon paradoxum*, the aspidogastrean *Aspidogaster limacoides*, the digenean *Asymphylodora kubanicum* and larvae of the nematode *Anisakis* sp. This fish therefore was potentially a source for human infection with *Anisakis*. Mokhayer (1989) reported metacercariae of the eye fluke, *Diplostomum spathaceum* from this species in Iran, which could cause complete blindness and death in commercially important species. Jalali and Molnár (1990a) recorded the monogeneans *Dactylogyrus frisii* from this species in the Khosk (probably Khoshk) River and *D. rarissimus* and two monogenean species, *Dactylogyrus* spp., from the Sefid River. Jalali and Molnár (1990b) recorded the monogeneans *Dactylogyrus frisii* and *D. rarissimus* at fish farms in Iran. Molnár and Jalali (1992) reported the monogeneans *Dactylogyrus suecicus*, *D. haplogonus* and *D. turaliensis* from this species in the Sefid River and Gussev *et al*. (1993b) also recorded *D. haplogonus* from Sefid River fish. Masoumian and Pazooki (1998) surveyed myxosporeans in this species in Gilan and Mazandaran provinces, finding *Myxobolus bramae*. Safari and Khandagi (1999) recorded *Clostridium botulinum* from 2.2% of fresh and smoked samples in Mazandaran Province.

Shamsi and Jalali (2001b, 2001c) detailed monogenean parasites for Sefid River and Caspian Sea samples, including six species of *Dactylogyrus*. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G. prostae* and *G*. sp. in fish from the Sefid River. Amini (2006) recorded *Gyrodactylus* sp., nematodes, *Diplostomum* sp., *Trichodina* sp., *Aeromonas* sp. and *Hydrophila* sp. in fingerlings from hatcheries in Iran. The latter two parasites caused a heavy mortality in the Shahid Rajaei hatchery ponds. Khara *et al*. (2008) found the eye parasite *Diplostomum spathaceum* in this fish from Boojagh Kiashahr Wetland in Gilan. Barzegar *et al*. (2008) also recorded this digenean, *Diplostomum spathaceum*. Sattari *et al*. (2008) reported the trematodes *Asymphylodora tincae* and *Aspidogaster limacoides* and the nematode *Raphidascaris acus* from fish along the southern Caspian Sea shore. Khara *et al*. (2009) found migratory fish from the Shirud had *Paradiplozoon chazarikum*, *Dactylogyrus* sp. (Monogenea), *Diplostomum spathaceum*, *Asymphylodora macracebelum*, *A. kubanicum* (Digenea), *Raphidascaris acus* (Nematoda) and *Aspidogaster limicoides* (Trematoda). Taati *et al*. (2009) examined fingerlings from aquaculture ponds in Gilan and found the monogeneans *Dactylogyrus* spp., metacercaria of the digenean *Diplostomum spathaceum*, the cestode *Bothriocephalus gowkongensis*, the nematode *Camallanus lacustris*, and the crustacean *Argulus foliaceus*.

Besmel *et al*. (2010) examined migratory fish from the Babolsar River finding *Asymphylodora kubanicum* and *Aspidogaster limacoides* (Digenea), and *Dactylogyrus* sp. and *Paradiplozoon chazarikum* (Monogenea) with age and sex differences in infestation. Khara *et al*. (2011) studied the prevalence of infection in migratory fish in the Tajan River and its effect on haematological parameters. Parasites were *Paradiplozoon chazarikum*, *Dactylogyrus* sp., *Diplostomum spathaceum* and *Asymphylodora kubanicum* but there was no relationship between parasites and blood parameters. Rahanandeh (2010) and Rahanandeh *et al*. (2011) examined fish from the southwest Caspian Sea and recorded *Ichthyophthirius multifilis*, *Chilodonella hexastica*, *C. piscicola*, *Trichodina* sp. (protozoans), *Paradiplozoon chazaricum*, *Dactylogyrus frisii*, *D. nybelini*, *D. rarissimus*, *D. turaliensis* (monogeneans), *Diplostomum spathaceum*, *Aspidogaster*

limacoides, *Asymphylodora kubanicum* (trematodes), *Bothriocephalus gowkongensis* (cestode), *Raphidascaris acus*, *Dioctophyma renale*, *Eustrongylides excisus* (nematodes) and *Lernaea cyprinacea* (crustacean). Rahanandeh *et al*. (2016) found damage to gut tissues by the digenetic trematode *Aspidogaster limacoides* in fish caught by Iranian beach seines, including hyperaemia, haemorrhage, inflammation, cellular degeneration, mucosal damage, tissue adhesion and displacement, hyperplasia, and necrosis.

Ghiasi *et al*. (2012) found a relationship between chemical and physical water factors and the incidence of aquatic and saprophytic fungi on eggs in hatcheries. *Saprolegnia* spp. were the only aquatic fungi found while saprophytic species belonged to the genera *Fusarium*, *Penicillium*, *Aspergillus*, *Moucor*, *Pscilomyces* and *Alternaria*. Zamani *et al*. (2013) found that apparently healthy fingerlings may harbour spring viraemia of carp, a *Rhabdovirus carpio* infection, also called swimbladder inflammation, and a major threat to both native and farmed fish populations. Ghasemi *et al*. (2014), Zamani *et al*. (2014) and Omidvar *et al*. (2016) experimentally infected fingerlings and fry with spring viraemia of carp virus and found it to be highly pathogenic with a mortality rate of 75-85% and haematological and immunological effects. Immersion was the best route of transmission with the highest mortality in fingerlings and intraperitoneal injection in fry. Also, the viral genome was detected in apparently healthy tissues showing this fish could be a vector of the virus. Taheri *et al*. (2014) identified intestinal bacterial flora from farm pond fish in Qom Province as *Klebsiella* spp., *Bacillus licheniformis* (a probiotic candidate), *Bacillus* spp., *Aeromonas* spp. (dominant), *Streptococcus* spp., *Pseudomonas* spp., *Vibrio* spp., *Erysipelothrix* spp. and *Citrobacter* spp. Zorriehzahra (2014) studied viral nervous necrosis in golden grey mullet in the Caspian Sea as this is a major constraint on aquaculture and has the potential for transmission to kutum. Asgharnia *et al*. (2017) recorded the parasites on fingerlings being released into the Sefid River and found the trematodes *Diplostomum spathaceum*, *Posthodiplostomum* sp., *Ichthyophthirius multifilis*, *Trichodina* sp. *Dactylogyrus* sp. and *Gyrodactylus* sp. with the highest prevalence amount, mean intensity, mean frequency and parasite number range in *Dactylogyrus*. Rezvani *et al*. (2017) identified the monogenean *Octomacrum europaeum* from the gills of this species. Vahedi and Pazooki (2017) captured 33 fish, 20.0-40.5 cm, from Sari, Mazandaran and investigated monogeniasis. Mean infection intensity and frequency of Dactylogyridae and Diplozoidae families of parasites were respectively 118, 100% and 4.53, 78.78%. Gills showed filament demolition and adhesion of gill lamellae, epithelial cell hypertrophy and hyperplasia of gill blades, separation of the epithelium from the basement membrane of the blades, aneurysm and clubbing. The total number of chloride cells decreased but there was no change in their size.

Tavassoli and Moghir (2002) described a squamous cell carcinoma in the oral cavity of this species, the first record for the Caspian Sea.

Economic importance. Sefid mahi or kutum is the most popular food fish in Iran as well as being important in Russia, Azerbaijan and Turkmenistan. This is also reflected in the literature on this species (e.g., the word “kutum” is mentioned well over 1,000 times in these two volumes on Carps and Minnows). An overview of its exploitation is given by Rabazanov *et al*. (2017, 2019) who covered fisheries in countries in addition to Iran in the Caspian Sea and gave recommendations for management actions. Rabazanov *et al*. (2019) also summarised catches in Iran and noted that in recent years these were stable and were associated with stocking programmes.

It is the freshwater fish with the highest economic value in Iran (Azari Takami *et al*. (1990) and Afraei Bandpei *et al*. (2008) recorded 10,773 fishermen making a living from its

capture). More than 70% of bony fish caught in the coastal Caspian Sea of Iran were this fish (Yousefian and Mosavi, 2008) or 78% and 76.6% of the income (Afraei Bandpei *et al*., 2011). Afraei Bandpei (2014) analysed the bony fish, beach seine, catch along the Iranian shore of the Caspian Sea for 2008-2009 and found cooperatives took 13,000 metric tonnes of which kutum accounted for 10,138 mt. Kutum contributed 76.6% of sales of bony fish with an estimated income of US$30,415,998. Fishermen's income from kutum was 74% for Gilan, 85.8% for Mazandaran and 26% for Golestan. The average break-even catch was more in the Mazandaran zone. The annual value of the catch in Iran from 2004 to 2008 varied from $34 million to $50 million and comprised most of the total annual export value ($49-88 million) of fishery products from Iran between 1997 and 2008 (Rabazanov *et al*., 2019). Fazli and Daryanabard (2017) found it comprised 66.24% of 123 beach seine catches in 2009-2012 along the whole Caspian coast, followed by mullets (Mugilidae), carp (at 1.31%) and shads (Clupeidae). The average annual catch from 1991 to 2001 was about 9,600 t (Afraei Bandpei *et al*., 2010). The catch in 2006 and 2007 was 16,117.5 t (Heidari *et al*., 2009). Fishing was banned from May through September in the southern Caspian Sea (Afraei Bandpei *et al*., 2011). Kutum and mullets (Mugilidae) comprised more than 98% of the total catch in the Iranian Caspian Sea (Fazli *et al*., 2014). Kutum were mostly caught in autumn and winter in depths less than 20 m in the central region.

It may be available out of season as mahi qachaq or bootleg fish, an indication of its popularity. About 35% of all Iranian catches were estimated to be illegal (Rabazanov *et al*., 2019). Batmanglij (1999) noted that this fish may be baked and served with herbed rice. A stuffing consisted of garlic, parsley, tarragon, scallions, coriander, mint, ground walnuts, barberries, raisins, lime juice, salt and pepper, sautéed in butter (he also incorrectly referred to mahi-e sefid as striped bass). In 1996, a news report stated that "In the port city of Anzali, one small white fish sells for $10" (www.iran-e-azad.org/english/boi/03400201.96). In Rasht, 60% of the inhabitants consumed no other fish and "86% of ladies in Rasht can only cook one kind of seafood" (Khairkhah, 1994). Ouseley (1819-1823) reported that this species "seemed most abundant, and was found in all the great rivers of this country near the sea; for several days it had furnished the principal dish of my dinners and often of my breakfasts". Holmes (1845) recorded catches with cast-nets in the Anzali Talab over 175 years ago which were even then worth £1,400-1,500. O'Donovan (1882) reported that a small stream in the Atrak River drainage was so crowded with this species that individuals could only move by floundering and jumping over one another, and the horses in crossing the stream, trod them to death by scores. Lönnberg (1900a) reported an annual catch of some millions in Persian waters.

It was caught in rivers and lagoons and by large, mechanically hauled beach nets in the Caspian Sea. Sea nets can be 1,500 m long and 18 m deep. The fishing season began in October and reached a maximum between 20 February and 10 March, ready for the "Now Ruz" or New Year celebrations when many Iranians ate this fish with rice (Emadi, 1979). Gill nets were also used (Aghili and Mohammadi, 2012).

The roe of this species was also eaten, salted or unsalted (the fish are called asbalan mahi and the roe shur-e asbal in Gilaki, the local dialect of Gilan). Whole female fish were soaked for one year in a mixture of salt and madder in special clay jars. The jars were traditionally buried in the ground and hermetically sealed but a modern technique has the roe removed from the fish after 20 days. Esmaeilzadeh *et al*. (2004) studied the nutrient composition and marinade qualities of this fish and compared them to those for grass carp (*Ctenopharyngodon idella*), the latter being preferable according to the organoleptic properties. The marinades could be stored for 6 months at 10ºC. Alipour *et al*. (2009) studied the effects of different brine concentrations and

temperatures in traditional smoking of this fish, finding a brine concentration of 26% gave the better quality and taste. Sahari *et al*. (2014) examined vitamin loss during storage of frozen fish, some vitamins showing significant loss and others not - this species had the highest vitamin A content of five species studied, for example. Mahjoorian *et al*. (2018) incorporated 1% clove essential oil with gelatin from fish scales to make a biodegradable, edible packaging film, which had the best physical, mechanical and antimicrobial properties. Mahjoorian *et al*. (2020) optimised the extraction of gelatin, which has many applications in the food, pharmaceutical and cosmetic industries, from scales, by-products of fish cleaning. Fish oil was prepared from kutum abdominal waste mechanically using heat and centrifugation (Babakhani, 2021). The oil contained 15% polyunsaturated fatty acids. The ratio of n3 to n6 fatty acids and the total amount of eicosanoic and docosahexaenoic fatty acids were 4.88 and 9.68, respectively. The results showed that the oil maintained good quality in terms of fatty acids and lack of microbes and could be used as a raw material for omega 3 oils.

The average weight of fish caught in the Anzali Talab in the early years of this century was 2 kg, the catch in the 1914-1915 season was 47,000 fish and in 1913-1915 123,000 fish. On 26 February 1914 a single haul in the sea near Anzali took 41,045 fish (Iljin, 1927; Berg, 1948-1949). Iljin (1927) estimated a yearly catch in Anzali Bay (= Talab) to be 3-4 million fish, a figure conflicting with these other reports.

Nevraev (1929) gave catches for various fishing regions in Iran in the early twentieth century. For the period 1901-1902 to 1913-1914 the catch in the Astara region was 0 to 29,053 individuals, for 1901-1902 to 1917-1918 the catch in the Anzali region was 2,565 to 124,195 individuals, in the Sefid River region from 1904-1905 to 1917-1918 the catch was 100 to 31,799 individuals, and in Astrabad (= Gorgan) region from 1900-1901 to 1912-1913 the catch was 4,000 to 323,500 individuals. The total catch for Iran in the 1914-1915 season was 443,000 fish. The catch in Iran from 1956/1957 to 1961/1962 varied from 197,884 kg to 2,066,580 kg (Vladykov, 1964), from 1965/66 to 1968/69 it varied between 159 and 1,252 tonnes (Andersskog, 1970), from 1963/64 to 1968/69 it varied between 121.3 and 1,252 t (RaLonde and Walczak, 1970b, 1972), from 1987 to 1991 it varied between 3,500 t and 8,855 t (Holčík and Oláh, 1992), and between 1989 and 1998 it varied between 11,792 kg and 14,336 kg (Caspian Environmental Programme, 2001a) - catch figures are at variance with each other. Holčík and Oláh (1992) reported a catch of 3,107 kg in the Anzali Talab for 1990 and for 1932-1964 a range of 95.1-3,488.9 t. They were also caught in rogas and inflowing rivers of the talab in late winter and early spring.

Moghim *et al*. (1994) estimated that coastal areas of the southern Caspian Sea had a total biomass of 24,000 t with a maximum sustainable yield of 7,000 t. In 1993-1994, the total catch of this species, including the illegal catch, was 11,175 t with the total stock estimated at 25,400 t and a maximum sustainable yield of 9,300 t. More than 25% of the catch was young fish indicative of non-standard methods being used (*Annual Report, 1995-1996, Iranian Fisheries Research and Training Organization, Tehran*, pp. 19-20, 1997). In 1994-1995, the biomass of this species in Iran was 241,000 t (*sic*, probably 24,000 t) and the maximum sustainable yield was 9,000 t (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, p. 37, 1996). About 62% of the bony fish catch in the Caspian Sea of Iran in 1993-1994 was this species with *Liza aurata* (= *Chelon auratus*, golden mullet) second at 22% (*Annual Bulletin 1993-94, Iranian Fisheries Research and Training Organization, Tehran*, p. 83, 1995). The catch from beach seine cooperatives along the Iranian coast was 8,477 t in in 2004-2005, a 2,500 t decrease over the previous year, and 45.5% of the total bony fish catch. Catch per unit

effort was 93.3 kg/set. The biomass of this species in Iranian coastal waters for 2003-2004 was estimated at about 25,000 t (Abdolmalaki, 2006a; Abdolmalaki and Ghaninezhad, 2007a). Kalantarian *et al*. (2017) found that the beach seine fishery at Salmanshahr, Mazandaran caught 58.17 kg per seine haul and this was the most abundant species caught at 48.31%.

Bartley and Rana (1998a, 1998b) commented that the fishery collapsed in 1980 but had risen from 500 tonnes in 1981 to around 10,000 t in 1996 after restocking from around 400,000 fingerlings/year in 1981 to around 142 million/year in 1997. Rana and Bartley (1998) noted that 7 million 1 g fingerlings were released into the Caspian Sea in 1997 which contradicted their earlier report. There was only a state-supported stocking programme but ERM-Lahmeyer International GmbH, DHI Water & Environment and GOPA Consultants (2001a) noted that this fish was being successfully managed in Iran while it had been fished almost to extinction in waters off Dagestan and Azerbaijan. Since 2000 releases have exceeded 200 million fish annually and three strategies are used: 1) spot planting with release of larvae and fingerlings at the same time, 2) scatter planting with release of fry at several sites in the same region, and 3) trickle planting with release of fingerlings in the same region over a period of time (Rabazanov *et al*., 2019). Market price was high at about U.S. $5.00/kg, five times the price for silver carp. Export prices were higher, 700 g of smoked mahi sefid cost £21.00 in 2004 (www.superhormuz.com, downloaded 19 January 2004). However, this species was difficult to culture beyond the 40-50 g stage and growth was slower than common carp.

The conflicting ranges seen in Andersskog and RaLonde and Walczak above are typical of the wide variations in reports; figures can only be taken as general guides for many Iranian fisheries. Abdolmalaki (2006b) stated that fluctuations were due to destruction of spawning grounds, overfishing and release of fingerlings. The mean catch sizes were 3,110 tonnes in 1937-1947, 990 t in 1967-1977 and 8,505 t in 1987-1997. A minimum catch of 121 t was taken in 1964 and a maximum of 11,175 t in 1994. Catch-per-unit-effort also showed high variation. The calculated stock biomass was 1,300 t in 1971 and between 18,489 and 25,400 t between 1990 and 2000. The mean biomass in the past 10 years was 22,750 t, a 17-fold increase over the year 1971. The catch in the previous 10 years was 35-46% of the annual stock. A decrease in stock size during 1998-1999 was attributed to an exploitation rate being more than maximum sustainable yield, a decreased mean weight of released fingerlings and a lowered return rate. Mohammad Nejad Shamoushaki *et al*. (2013) reported a decline in fishing cooperative catches of 22.5% from 2009 to 2011.

Catches in the Bandar-e Anzali area have been as high as 5,480 t in 1939-1940 but fell to 85 t in 1961-1962 (Vladykov, 1964; RaLonde and Walczak, 1972) but have risen again as indicated above. This was attributed to the massive stocking effort with 170 million fingerlings released in Iran in 1991, about a quarter in the Anzali Talab (Holčík and Oláh, 1992). The Sari hatchery produced 400 million “white fish” over the previous 10 years (*Tehran Times*, 30 May 1998). Sea ranching increased the yearly catch to 8,500 t in 1991, the highest recorded catch in the past being 5,850 t in 1940 (Emadi, 1993a). Natural stocks in the past were very high. Migrating fish were so dense at the talab mouth that they were caught in buckets and jumping fish literally fell into boats.

Salehi (2003b) analysed the economics of production of fingerlings in Iran. The cost of labour was 50%, feed and fertiliser 20%, maintenance 10%, and harvesting, handling and releasing 6%. The average cost per fingerlings was 37 rials in 2001 (rising to 123 rials in 2003 (Salehi, 2008a)). As the average rate of fingerling return was 8.3% and the average weight and age of commercially caught fish was 815 g and 3.7 years, it was expected that 19,257,494

individuals weighing 16,000 t would be harvested over the Iranian year 2004-2005. The value would be an estimated 345 billion rials at the 2001 price (8,050 rials to a U.S. dollar in 2001; $42.86 million). Salehi (2008a) estimated the wholesale price of the catch as 505 billion rials in 2004 and reviewed the comparative economics of fingerling production for 2001-2003.

Fazli *et al*. (2012) examined changes in biomass and condition index in relation to stock enhancement during 1991-2011 in the Iranian Caspian Sea. Length and weight ranged from 18 to 70 cm fork length and 75 to 5,750 g, higher for females except in 1998-1999. Age ranged from 2 to 9 years with ages 3 and 4 the largest groups at 25.8% and 28.5%. The condition factor declined in both sexes from 1.48 in 1991-1992 to 1.29 in 2010-2011 for females and from 1.4 to 1.2 in males. The annual survival rate was estimated to be 0.25/year. The instantaneous coefficient of natural mortality was 0.39/year and the instantaneous coefficient of fishing mortality varied over the 20 years between 0.2/year and 1.04/year (0.2 to 0.42/year when the first two years were omitted due to poor computation). The exploitation ratio was 0.34 to 0.73. Biomass estimates increased from 34,700 mt in 1991-1992 to 40,900 mt in 1993-1994, declined to 28,800 mt in 2001-2002, increased to 56,900 mt in 2006-2007, and declined again to 42,600 mt in 2010-2011. The total number of kutum fingerlings released increased from 110 million in 1991 to 400 million in 2010-2011. There was a significant positive correlation between fingerling release and recruitment while condition factor was adversely affected. Recent data showed biomass and catches were not benefiting much from increased efforts at fingerling release.

Experimental culture of triploid mahi sefid has been carried out at the Gilan Fisheries Research Centre (*Iranian Fisheries Research and Training Organization Newsletter*, 2:2, 1993) to increase fish weight for exploitation but apparently was unsuccessful although the techniques worked with grass carp, *Ctenopharyngodon idella* (*Annual Bulletin 1993-94, Iranian Fisheries Research and Training Organization, Tehran*, pp. 70-71, 1995). In addition, monoculture and polyculture of this species has been investigated, the latter with grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*) (*Iranian Fisheries Research and Training Organization Annual Report*, 1992-93; Danesh Khoshasi, 1997). From an average initial weight of 7 g, monocultured fish weighed 158 or 177 g on average at the end of each of two one-year periods, polycultured fish weighed 158 or 168 g, and maximum weight attained was 250 or 300 g (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, p. 38, 1996). Danesh Khoshasi (1997) gave figures of 177 g for mono-cultured fish after 6 months in ponds, polycultured fish weighed 185 g (with a maximum of 300 g) while stocking with 7 g fish gave 168 g and 192 g for mono- and polyculture fish respectively (maximum weight 250 g) (these two reports on the same experiment have confusing figures). The fish were fed on pellets especially made for this species, nitrate and phosphate fertiliser and cow and chicken manure were added to the ponds, and water temperature was 15.0-27.64°C. Growth in Iranian fish farms was up to 1.5 g in 8 weeks after a hatching rate of 75% (Aslaanparviz, 1994).

Moradinasab *et al*. (2015) noted the presence of kutum in the kilka by-catch (*Clupeonella* spp., Clupeidae) on the Bandar-e Anzali fishing grounds although it, along with five other species, only comprised 0.2% of the kilka catch.

Elmi *et al*. (2018) converted waste fish scales from this species into a magnetic hydroxyapatite bionanocomposite for the removal of heavy metals from groundwater. Karimzadeh (2018) extracted glycosaminoglycan from fish scales (a fishery waste) of *R. frisii kutum* (= *R. kutum*) and showed it had valuable anticoagulant properties compared to synthetic anticoagulant compounds such as heparin. Naderi Gharahgheshlagh *et al*. (2020) isolated and

characterised collagen from the skin of kutum and Naderi Gharehgheshlagh *et al*. (2021) used it and chitosan from shell waste of shrimp for in vivo second-degree burn wound healing in rats, finding a 1:1 ratio could significantly restore burn wounds compared to silver sulfadiazine ointment.

Experimental studies. This species has been studied extensively in Iran as the most popular food fish and is second only to *Cyprinus carpio* in the number of studies. Some sections below are separated by year groups to show the growth in studies. Certain topics may appear in different sections as they are studied in combination, e.g., stress may be a study on its own or may be combined with a study on feeding, growth, survival, etc. These studies are not replicated in each section and readers should search other sections for this additional information.

Pollution:-

Tehranifard *et al*. (2002, 2007) reported on the effects of anionic detergents and the pesticide diazinon on the LC_{50}, both separately and in combination, in fingerlings. The LC_{50} 96 h for diazinon was 0.34 mg/l, for liquid and powder detergents values were 4.69 and 12.24 mg/l, and for mixtures of diazinon and liquid detergent and diazinon and powder detergent were 7.27 and 0.9 mg/l. Shariati *et al*. (2004) recorded the toxicity and LC_{50} 96 h of phenol and 1-naphthol as 21.5928 and 2.1544 mg/l. Gharaei *et al*. (2006) and Gharaei and Esmaili-Sari (2008) studied the acute LC_{50} 96 h (0.086 mg/l) and bioconcentration (96 h exposure 2.8, 16.8 and 26.65 mg/l in tissue, kidney and gill respectively) of mercuric chloride in juveniles. Choobkar (2007) examined the survival and growth of larvae and fry exposed to the pesticide trichlorfon, finding it not harmful if the proper concentrations were used and stocking was delayed so that the pesticide degraded. Farokhrous Lashydany (2007) measured the effects of the herbicide butachlor on sexually mature fish, finding a decrease in testosterone and sperm production and an increase in abnormal sperm. Foroughi *et al*. (2007) determined mercury content, which varied between tissues, was not significantly different between sexes and was lower than permissible limits in fish from the south-central Caspian Sea. The mean concentration of mercury in muscle, liver and skin tissues was 849.9, 670.9 and 493.7 ng/g, respectively. Gholami *et al*. (2007, 2010) found that the permissible limits for pollutants in fry were 0.021 mg/l for cadmium, 0.4 mg/l for copper, 1.16 for the anionic surfactant used in LAS detergent (linear alkylbenzene sulfonate), 0.004 mg/l for a mixture of cadmium and LAS, and 0.009 for a mixture of copper and LAS. Gholami and Falahi (2008) showed that copper and cadmium transmission in the food chain was significant individually and when mixed with LAS detergent. Vaezzadeh *et al*. (2008) found the levels of the pesticide heptachlor in fish from Hashtpar and dieldrin in fish from Kiashahr could have a health risk to consumers. Mohammadnezhad Shamoushaki *et al*. (2009) determined the LC_{50} 96 h for the insecticide endosulfan was 0.002 mg/l, above the maximum allowable concentration at 0.0002 mg/l.

Elsagh (2010) recorded levels of the heavy metals zinc (mean 32.4 mg/g), cadmium (1.205), iron (90.716) and copper (9.455) in fish from the Caspian Sea. Farokhruz Lasheydani *et al*. (2010) studied the deleterious effect of the herbicide butachlor, used to control weeds in rice fields, on haematological parameters. Mohammad Nejad Shamoushaki (2010) found that the pesticide diazinon adversely affected various haematological and immunological parameters as well as various tissues although there was no effect on weight and length. Mohammad Nejad Shamoushaki *et al*. (2010) determined the lethal concentration (LC_{50} 96 h) of the herbicide roundup (glyphosate) used in agriculture was 5,189 mg/l. Elsagh (2011) found Iranian fish fillets with cadmium and lead levels above accepted limits for human consumption. Eslami *et al*. (2011) measured trace element levels in various tissues of fish from the Tajan River where

nearly all non-essential metals (cadmium, lead, nickel) were higher than official limits in the edible muscle, for example. Hosseinie *et al*. (2011) carried out a risk assessment for mercury in Mazandaran and found consumption of kutum was not a threat to consumer health. Mohammad Nejad Shamoushaki *et al*. (2011a, 2011b) studied the effect of sublethal concentrations of the pesticide diazinon on haematological and hormonal parameters of male brood stocks, finding the LC_{50} 96 h was 0.4 mg/l, various aspects of blood and hormones were adversely affected, there was no effect on average weight and body length and on average weight of the heart and brain but there was a decrease in gonad weight and gonad index as well as atrophy, fibrosis and necrosis in the testis, vascular congestion, changes in heart structure, and vascular congestion and oedema in the brain. Sharifpour *et al*. (2011) examined experimentally the effects of the water-soluble fraction of crude oil on gill tissue of juveniles, finding an LC_{50} 96 h at 33.95 p.p.m. and serious damage to the gill affecting homeostasis. Einollahi *et al*. (2012) measured polycyclic aromatic hydrocarbons in adipose tissue and the liver from fish at the Nowshahr oil jetty. Elsagh (2012) found levels of cobalt, copper and zinc were higher than acceptable limits at 0.3, 9.45 and 29.97 μg/g dry weight, respectively, while manganese at 0.2 μg/g was not. Fadakar Masouleh *et al*. (2012) found that the injurious effects of mercury on the testis and spermatozoan motility had a direct relationship with time of exposure and concentration of the toxin. Fekri *et al*. (2012) studied the effects of the pesticide diazinon on haematological fluctuations and stress factors, cortisol and glucose being increased for example. Mohammadnezhad Shamoushaki *et al*. (2012) studied the pesticide diazinon in male breeders, finding an LC_{50} 96 h of 0.4 mg/l, effects on body weight and length and on spleen weight, and deleterious effects on various body organs such as necrosis, inflammation, bleeding and hypertension, among others. Mohammad Nejad Shamoushaki *et al*. (2012) also recorded various changes in haematology and biochemistry of male broodstocks exposed to long-term, low-level concentrations of the organophosphate diazinon. Monsefrad *et al*. (2012, 2012) found the concentration of heavy metals was influenced by reproductive status (and the fish sampled were safe for human consumption), and found interactions between metals in fish tissues influenced accumulation of toxic metals. Nasrollahzadeh Saravi *et al*. (2012) discovered high levels of polyaromatic hydrocarbons in edible tissue, higher than corresponding sediment concentrations, with the highest levels in samples from the Caspian Sea ports (Anzali, Babol Sar, Nowshahr) affected by intensive shipping activities. Sadat Naeemi (2012) showed that linear alkylbenzene sulfonate (widely used in detergents and found in Iranian Caspian Sea wastewater) had deleterious effects on the gills, kidney and liver, particularly the former. Shokrzadeh Lamuki *et al*. (2012) evaluated pesticide residues in fish from four major fishing centres (Babol Sar, Chalus, Khazarabad and Miankaleh) and found mean D.D.T. values ranged from 0.018 to 0.029 mg/kg and D.D.A. from 0.019 to 0.031 mg/kg. Askary Sary and Velayatzadeh (2013) showed fish from Sarcheshmeh Market, Tehran had levels of lead and zinc in liver and muscle above acceptable limits. Mohamadian *et al*. (2013) studied the effect of mercury chloride on embryonic development, finding an LC_{50} 96 h of 102.91 p.p.b., and increasing mortality, growth reduction and abnormalities with increasing concentrations of the chemical. Naeemi *et al*. (2013, 2013) found severe histopathological changes of the gill, liver and kidney of fish exposed to sublethal concentrations of the synthetic anionic surfactant used for cleaning, linear alkylbenzene sulfonate. Azimi *et al*. (2014) found juveniles were resistant to nitrite poisoning and changes in liver tissue could be used as a biomarker of nitrite pollution. Hassanpour *et al*. (2014) determined levels of heavy metals (cadmium, copper, lead, zinc) in fish from the Miankaleh International Wetland where cadmium and lead levels exceeded international standards. Khoshnood *et al*. (2014) studied the toxicity of

atrazine, an herbicide, on fry where the ion composition was affected and major damage to the gill epithelium was observed, but there was no effect on growth parameters. Shahbazi *et al*. (2014) measured an LC_{50} 96 h of the insecticide malathion at 0.86 mg/l for 3 g fish in experimental conditions, highly toxic, also showing significant decreases in haematocrit with increasing malathion concentrations, and with symptoms being irregular eye protrusion and irregular swimming movements. Shirdel and Kalbassi (2014) assessed the sensitivity of juveniles to acute toxicity of nonylphenol, a toxic microbial degradation product of a compound used in surfactants, paints, emulsifiers, lubricants, pesticides and detergents, the LC_{50} 96 h being 1,262.36 μg/l or moderately toxic. Soltani *et al*. (2014) found concentrations of heavy metals (cadmium, copper, lead) in edible tissue of fish from Babol Sar and Tonekabon were safe for consumers.

Hoseini *et al*. (2015) found higher levels of lead and cadmium in liver over muscle tissue in Mazandaran samples, of lead over cadmium, and differing with some station sites particularly those near industrial waste regions but below hazardous health levels. Khoshnood *et al*. (2015) studied the histopathological effects of the herbicide atrazine on gills of fingerlings, which caused a wide range of damage, presumably affecting respiration and ion regulation, and proved to be highly toxic even at a sublethal concentration (12.47 mg/l). Khoshnood *et al*. (2015b) found the LC_{50} of atrazine for fry was 18.53 p.p.m. and atrazine affected ion composition of the body even at sublethal concentrations but had no effects on growth. Nejatkhah Manavi and Kiadehy (2015) examined levels of the pesticide lindane in muscles of fish from Astara, Bandar Anzali, Bandar-e Torkeman, Chalus, Fereydun Kenar, Hashtpar Khazarabad Sari and Kiashahr, finding Chalus to be the most polluted and a declining trend in pesticide amount in recent years. Shahbazi *et al*. (2015) found that the insecticide cypermethrin had increased toxicity to fry and more deaths occurred with increased temperatures. Shamloufar *et al*. (2015) determined an LC_{50} 96 h of juveniles exposed to the insecticide sevin of 3.0654 mg/l, and it was moderately toxic, causing abnormal swimming, blocked respiration and loss of colour, hyperplasia, oedema, inflammation, and damage to gills, liver, spleen and kidney. Sinkakarimi *et al*. (2015) examined fish from the southeastern coast of the Caspian Sea and found mean concentrations of cadmium and lead over the previous five years exceeded various national and international standards. However, adults could consume 0.21 and 0.75 kg/day of fish in terms of cadmium and lead content and children 0.05 and 0.26 kg/day without any health risk. Dadar *et al*. (2016) studied the bioaccumulation in edible muscles of the heavy metals arsenic, cadmium, cobalt, copper, lead, manganese, mercury and zinc in male and female fish from the Noor and Babol Sar coastal regions of the Caspian Sea, and found accumulation of zinc in Babol Sar fish varied with sex and arsenic and mercury with sex at Noor (higher in females), and levels were not a consumption threat.

Mazandaran, Caspian Sea at Noor
(Iran - Mazandaran - Nour - Caspian Sea – panoramio, CC BY 3.0, Alireza Javaheri).

Golshani (2016) found that toxin accumulation in fish from five estuaries on the Caspian Sea of Iran was strongly controlled by habitat and feeding habits. The herbivorous carp had the middle level toxin concentration, less than the detritivore *Liza aurata* (= *Chelon auratus*, golden mullet) and more than the carnivore *Rutilus kutum*. The acetylcholinesterase enzyme activity was gradually inhibited with increase in organophosphorus pesticide concentration. Hosseini *et al*. (2016) assessed heavy metals content of muscle in fish from the south-central Caspian Sea finding the estimated daily intake of all metals was below international levels and therefore there was no risk for consumption in moderation. Kardel *et al*. (2016) studied heavy metal (cadmium, lead, zinc) accumulation in fish from the Babol Sar coast, finding less in liver tissue than in *Liza aurata* (= *Chelon auratus*, golden mullet) but no difference for gill tissue. Levels in both tissues were higher than acceptable limits (compare above). Pourkhabbaz *et al*. (2016) found LC_{50} 96 h values for copper sulphate and mercury chloride on fingerlings were 1.47 mg/l and 0.28 mg/l respectively, mortality decreased with time, and most deaths were in the first 24 hours. Shokrzadeh *et al*. (2016) found diazinon levels in fish from the central coast of the Caspian Sea were acceptable for human consumption. Farahbakhsh *et al*. (2017) studied the amount of copper, nickel and zinc in muscle tissue, and nickel was higher than international standards, but the potential risk and hazard indicators indicated there was not much danger to consumers. Heshmati *et al*. (2017) compared wild and farmed fish for toxic and trace elements (arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium and zinc) in muscle tissue of fish from the southwest Caspian Sea, finding arsenic to be below the detection limit, iron was the highest concentration in both wild and farmed fish, cadmium, lead, mercury and manganese were higher in wild fish, others showed no difference between wild and farmed fish, and the estimated daily intake for humans was acceptable, and hazard quotient values showed no health risk to consumers. Moradi *et al*. (2017) measured the amount of the hydrocarbon benzo[a]anthracene in fish from the Anzali Wetland, finding no significant differences between

sample areas and levels lower than international health standards (20 μg/kg dry matter). Salehi Borban *et al*. (2017) examined fish from the Mahmoudabad area and found levels of arsenic, cadmium, copper, iron, lead and mercury in muscle and fish oil were near or below harmful levels and did not pose a health problem for consumers. Sinka Karimi *et al*. (2017) carried out a review and meta-analysis of lead concentrations in fish from the southeastern coast of the Caspian Sea and found a great difference between the various studies in terms of the reported effect factor. Current consumption led to no serious health risk and 0.23 kg/day for adults and 0.048 kg/day for children without effect. Farhangi (2018) found that for fingerlings under stable conditions and aeration the lethal concentrations of nickel and iron were 40mg/l and 155 mg/l respectively and the sublethal concentrations were 19.35 mg/l and 124.52 mg/l. Higher concentrations of these metals showed convulsions, open operculum and various types of gill damage. Pourang *et al*. (2018) sampled fish from areas adjacent to the estuaries of the Gorgan, Sefid and Tajan rivers and applied elemental fingerprinting to seven soft and hard tissues (liver and muscle, dorsal spine, eye lens, otolith, scale and vertebra). There were no significant relationships between the elements and such biological characteristics as weight and length. The levels of copper, iron, manganese and zinc in muscle were far below the recommended limits for human consumption. Seifzadeh *et al*. (2018) found bioaccumulation of the pesticides aldrin, diazinon and endrin in muscle tissues of fish from the Anzali Wetland were lower than international detection limits and so consumers were not at risk. Sharifi *et al*. (2018) showed that fish from the southern Caspian Sea coast were safe to consume in respect of cadmium levels (mean 0.38 μg/g wet weight in muscle). Alijani Ardeshir *et al*. (2019) measured the genetic toxicity of fipronil insecticide on the liver and found increasing damage to DNA with dosage, reducing the survival rate of fingerling and larva, and possibly expanding gastrointestinal cancer in humans in the northern provinces of Iran. Fathabad *et al*. (2019) recorded heavy metal concentrations in fish from the Rasht Fish Market, finding the highest concentrations in this species among four examined for arsenic, lead, mercury, nickel and tin although all were at acceptable levels for human consumption. Forouhar Vajargah and Hedayati (2019) found the LC_{50} 96 h of the pesticide butachlor was 0.258 mg/l and was more toxic for this species compared to *Cyprinus carpio*. Heidari *et al*. (2019) showed fluctuations in metabolic enzymes indicated a change in the physiological state of fish under nanoparticle stress (copper oxide and silver nanocolloid) that could threaten fry health. Sattari *et al*. (2019) investigated element concentrations in fish from five fishing regions in the southern Caspian Sea and found the highest concentrations of calcium and manganese in muscle tissue, aluminium, barium, cadmium, cobalt, iron, potassium, sodium, sulphur, tin, tungsten and zinc in kidney tissue, arsenic, lead, nickel and rubidium in gonad tissue, antimony, chromium, lithium, magnesium, phosphorus, silicon, strontium, thorium and titanium in skin tissue, and copper and uranium in liver tissue. Zakeri *et al*. (2019) found 66.6% of fish from Babolsar, Bandar Anzali, Chamkhaleh, Gomishan, Mahmoudabad and Tonekabon had microplastics in their guts, potentially transferable to humans.

Seifzadeh (2020) found that zinc had the highest concentration in muscle tissue followed by copper and cadmium in fish from the northern and southern Anzali Wetland. Various correlations were noted between length, weight, age and gender, e.g., positive correlation of copper with weight in the southern wetland and negative with age in the northern wetland. Metal levels rendered fish suitable for human consumption. Esmaeilbeigi *et al*. (2021) showed fingerlings exposed to the oil pollutant benzo [α] pyrene generally had DNA damage increased in the liver and gill cells as well as the frequency of micro- and bi-nucleated erythrocytes in a

time and concentration-dependent pattern. In addition, the liver and gill tissues displayed several histopathological lesions. Malvandi (2021) collected fish at four best-selling stations, Bandar-e Torkeman, Bander Anzali, Fereydun Kenar and Chalus, with mean mercury concentrations being 49.4, 132.6, 103.6, and 107.6 µg/g, respectively. Mercury in the muscle tissue increased from east to west. The mercury concentrations at all stations were below the permissible international levels for this heavy metal, suggesting no or low potential health risk. Taghizadeh Rahmat Abadi *et al*. (2021) recorded microplastics from fish samples, 33.0-48.5 cm fork length, sold for human consumption in Bandar-e Torkeman. On average, 11.4 microplastic items per fish (0.015 items per 1 g fish wet weight) were found in stomachs at an individual detection rate of 80%. It was recommended that the potential effect of microplastics on the trophic food web, particularly for human consumption and health, should be urgently investigated.

Diet:-

Novirian *et al*. (2007) carried out experimental studies on different lipid levels in food fed to cultured fry, a level of 12% increasing growth levels.

Talebi Haghighi *et al*. (2010) evaluated the effects of different levels of the synbiotic biomin imbo on fry. Positive effects on final weight, weight gain, specific growth rate, feed conversion ratio, protein efficiency ratio, feed efficiency and daily feed intake were found. Food conversion ratio showed a significant decrease and no difference in condition factor was observed. The synbiotic reduced feed cost and increased profit. Aftabgard *et al*. (2011) measured the effect of the prebiotic immunoster on growth (slightly better), survival (no change), blood cell density (increased), and body composition (protein, fibre and carbohydrate increased) of fingerlings. Enayat Gholampoor *et al*. (2011) found the highest rates of daily growth, specific growth and weight gain were at salinities of 2 and 4 p.p.t., lowest at 10 p.p.t., while food conversion ratio and condition factor along with various blood parameters and body composition showed no change. Jafari *et al*. (2011) showed a diet of *Artemia* nauplii with egg yolk increased growth and survival and gave a better body composition for larvae. Manafi Havigh *et al*. (2011) found replacing 30% of fish meal with soybean meal did not reduce growth and survival and was therefore optimal economically. Shahkar *et al*. (2011) found that larval growth varied with mixtures of proteins and frequency of feeding. Falahatkar *et al*. (2012) studied starter diets for larvae including *Gammarus* dry powder, shrimp dry powder, egg yolk dry powder and newly-hatched brine shrimp (*Artemia* nauplii). The latter was the best but the most suitable and inexpensive was egg yolk powder which gave high growth performance and survival rates. Mahmoodi *et al*. (2012) determined the growth needs of fry in protein being 30% and in fat 14%. Aftabgard *et al*. (2013) examined the immunoster prebiotic in the diet of fingerlings, showing little effect on growth performance but a significant immunostimulant effect on leucocytes and increasing the number of lymphocytes. Akrami *et al*. (2013) found that fry fed supplements of 5 g/kg mannan oligosaccharide had improved growth performance, survival and salinity stress resistance. Akrami *et al*. (2013, 2013) determined the effect of the dietary prebiotic mannan oligosaccharide with β-1, 3-glucan on growth, survival and body composition of fry, showing no influence and therefore this mixture was not appropriate for supplementation. Fathi (2013) fed fry with *Daphnia magna* enriched with essential fatty acids finding enhanced growth but no significant difference in survival rate with other treatments. Goli *et al*. (2013) found that food pellets containing various taste substances affected feeding behaviour; citric acid or sucrose, for example, increased consumption of pellets and the number of pellets consumed in relation to grasps, but not calcium and sodium chloride, and the effect of concentration change on retention time of pellets after the first grasp(s) was significant with all taste substances. Haghjou Jahromi

et al. (2013) showed how growth and survival was higher in larvae fed with *Artemia urmiana* nauplii enriched with vitamin C. *Artemia urmiana* is found in the Urmia salt lake. Hassantabar *et al*. (2013) investigated the growth rate, survival and activity of digestive enzymes (a-amylase and alkaline phosphatase) in larvae fed *Artemia* nauplii. Stocking in high density decreased growth efficiency but there was no considerable effect on survival rate of larvae. A significant increase in activity of amylase was found from 23 to 30 days and the highest amylase activity was found at 30 days after hatching. The high content of glycogen and carbohydrates in live food may have stimulated synthesis and secretion of amylase. An early peak of activity in alkaline phosphatase activity was observed at day 8 after hatching, indicating the maturation process in the intestines of kutum larvae. Karimzadeh *et al*. (2013) used dietary immunogen, a prebiotic, which improved nutrient efficiency and larval performance through growth stimulation by beneficial bacteria. Mirzaei *et al*. (2013) found that feed with different levels of highly unsaturated fatty acids had significant effects on growth, haematocrit and blood biochemical parameters. Roufchaie *et al*. (2013) found that fingerlings fed hoplite (a dietary supplement containing glucan) showed growth promotion and modulation of intestinal microbiota. Ghomi *et al*. (2014) studied the combination effect of the probiotic primalac and vitamin C on growth performance of juveniles, finding it better than controls, and recommending 0.3% probiotic and 200 mg/kg vitamin C in the diet. Hoseinifar *et al*. (2014) used dietary xylo-oligosaccharide for fry which had beneficial effects on mucosal immunity but none on growth performance or diet utilisation. Mahdavi *et al*. (2014) investigated the use of supplementary fennel essential oil (*Foeniculum vulgare*) in the diet of fry finding no significant effect on growth but 100 mg/kg promoted the immune system by increasing white and red blood cells. Mohammadzadeh *et al*. (2014) observed that increasing carbohydrate levels in juvenile diets from 15 to 35% led to an efficient protein ratio and optimal growth although there was no clear correlation between fish growth and thyroid hormones. Nekoubin *et al*. (2014) found the food additive L-carnitine, an amino acid, did not have a significant effect on growth but did on carcass quality. Rostandeh *et al*. (2014) studied the effect of the bactocell microbial probiotic on growth, survival and immunological factors in fry, finding no effect on growth but no mortality while blood and immunological parameters showed significant increases. Rufchaei and Hoseinifar (2014) found low levels of the dietary yeast glucan improved growth performance, body protein levels and survival rate of fry, stimulated the immune response, and modulated intestinal microbiota.

Adel *et al*. (2015, 2015) showed how *Mentha piperita* (peppermint) extract at a level of 3.0% in the diet of fry improved growth performance, survival rate, and increased the main haematological and immune humoral (both mucosal and systemic) parameters. Imanpoor and Roohi (2015) found that a supplement of 0.1% primalac, a probiotic, had a positive effect on growth performance and blood chemical parameters of fry but not survival and tolerance to salinity stress. Imanpoor and Roohi (2015) showed that the herbal supplement sangrovit could improve growth rate, feed utilisation and blood biochemical parameters of fry, although survival, condition factor and resistance to salinity stress were unaffected. Kamali Najafabad *et al*. (2015, 2016a, 2016b) showed that chitosan added to the diet of fingerlings at 1-2 g/kg increased survival rate, resistance to thermal stress and the height of intestinal villi, and improved feed conversion ratio and nonspecific defense mechanisms. Keramat Amirkolaie (2015) found the administration of 1 g/kg of the prebiotic immunogen in the diet improved nutrient efficiency and performance of fry through growth stimulation of beneficial intestinal bacteria. Khodabakhsh and Ghobadi (2015) studied the effects of replacing fish oil with sunflower and colsa (colza or rapeseed) oil in the diet of juveniles, finding no differences such that fish oil could be replaced

by these vegetable oils. Mahmoodi *et al*. (2015) found a diet of 35% protein and 14% lipid improved growth and they detailed biochemical changes in the fish. Amirisendesi *et al*. (2017) investigated the use of different levels of canola meal in the diet of fingerlings as a cheaper food than fish meal. AnvariFar *et al*. (2017a, 2017b) used different levels of dietary nucleotides supplementation in fry diet. This supplementation could strengthen the immune system, increase the level of absorption in the intestine, and increase the effectiveness of growth and osmotic stress response. Mortality was significantly different in these studies and cortisol levels were affected. Barari *et al*. (2017) studied the effects of the prebiotic immunowall (a yeast extract rich in β-glucans and mannan oligosaccharides promoting gut microflora) in the diet of juveniles, finding higher survival and increases in growth factors and body composition. Barari *et al*. (2017) also found weight gain, specific growth rate, growth rate, feed conversion ratio and body weight index for fish administered 0.15% immunowall showed statistically significant differences over a control. Barari *et al*. (2017) also found weight gain, specific growth rate, growth rate, feed conversion ratio and body weight index for fish administrated 0.15% primalac (a prebiotic additive) showed statistically significant differences. Bazarganpour *et al*. (2017) found that combo multi-enzyme, at levels of 1.5 and 2.0 g/kg in the diet, caused an increase in blood parameters and specific and non-specific factors in fingerlings. Jabbari *et al*. (2017) found that dietary betaine given to fingerlings had no effect on growth performance, feeding parameters, body composition, survival rate and resistance to stress. Karimzadeh and Zahmatkesh (2017) studied the effect of different dietary zinc levels on pyruvate kinase activity and electrophoretic pattern of muscle tissues in juveniles, finding that a 200 mg/kg level did not affect intensity of separated protein bands and pyruvate kinase activity of muscle. Mahdavi *et al*. (2017) found that fennel (*Foeniculum vulgare*) essential oil at 100 mg/kg in the diet of fry could improve the immune system by promoting biochemical parameters and also increased stress resistance. Mohammadzadeh *et al*. (2017) evaluated the effects of dietary carbohydrate levels on growth performance and digestive enzyme activities in juveniles, finding that increasing levels from 15% to 35% had positive effects on growth while enzyme activities increased from 15% to 35% in some but decreased above 25% in others. Soltani (2017) found that the application of combined dietary fructo-oligosaccharide with probiotic *Pediococcus acidilactici* and *Lactococcus lactis* was useful in early rearing of fry in terms of growth, for example. Rafiee *et al*. (2018) showed that dietary dried lettuce at rates between 8-10% could be used to replace fish meal, wheat and oats. Sayahan *et al*. (2018) used sesame meal instead of fish meal at different levels in the diet of young and found negative effects on growth parameters but not blood factors. Zamatkesh and Karimzadeh (2018) found juveniles fed a diet with 44% protein and 50 mg/kg zinc gave a better growth and body composition. AnvariFar *et al*. (2019) demonstrated that dietary nucleotides exerted a positive effect on the growth performance of fry and showed lower stress-induced apoptosis and cortisol elevation. Safavi *et al*. (2019) gave the synbiotic biomin imbo to fingerlings and found improved growth, feed efficiency and carcass composition as well as a stimulus for the non-specific defense system. Taati *et al*. (2019) found wheat gluten was not optimal for the kutum fry diet and cannot be substituted for fish meal.

Farabi *et al*. (2020) added salt to the diet of freshwater juveniles to improve survival during migration to brackish water. Karimzadeh *et al*. (2020) showed that fingerlings fed on nucleotides (Hilyses and Augic[15]) showed an improved growth performance and salinity resistance, and evidently required a larger nucleotide diet at early life stages to control stress related parameters such as cortisol and glucose. Rufchaei *et al*. (2020) found that adding *Pontogammarus maeotica* extract to the juvenile diet had no significant effect on growth

performance but did increase immunity.

Aquaculture:-

Imanpour *et al*. (2006) showed larvae reared under red light had better growth and survival.

Ataimehr *et al*. (2010) detailed the varied effects of different ions, osmolarity and water concentration on body tissues, gill chloride cells and mortality of different-sized juveniles and found, for example, mortality increased with salinity but decreased with increase in weight. Mohagheghi Samarin (2010) found stripping eggs should occur within 168ºC-hours after ovulation as a complete loss of viability occurred at 672ºC-hours, *in vivo* storage was more effective than *in vitro*, and successful *in vitro* storage could be used at least within 8 hours at 4-12°C. Shabani and Darvish Bastami (2010) compared the levels of ionic and non-ionic factors in blood of fish emigrating from the Tajan River, which regulated pH and influenced growth and reproduction. Fallahi (2010) showed that using slurry in aquaculture ponds was effective in promoting the growth of zooplankton which was the food of the fish larval stage. Imanpoor *et al*. (2011) examined 80 migratory, sexually-mature females and recorded sodium, potassium, magnesium, calcium, total protein, cholesterol and glucose in eggs, finding various correlations, and these factors could be effective in broodstock selection programmes and larval growth in aquaculture. Yousefian (2011c) found a positive correlation between fertilisation rate and egg size (larger eggs offered a larger target to sperm) and a negative correlation between fertilisation rate and fecundity (egg size decreased with increase in number of eggs), egg size therefore being important in aquaculture. Khosravi Bakhtiarvandi *et al*. (2012) investigated changes in growth and amino acid composition during larval development from one to 50 days after hatching. Farabi *et al*. (2013) showed that salinity and turbidity stress caused physiological changes in gill and kidney tissue of juveniles, and had direct effects on weight and survival. Goli *et al*. (2013) tested the behaviour of fingerlings exposed to various taste materials (calcium chloride, citric acid, sodium chloride and glucose), useful in feed preparation. Hosseinzadeh Sahafi (2009, 2013) and Hosseinzadeh Sahafi *et al*. (2012) tagged 10,450 and 15,930 fingerlings (respectively, the former probably part of the latter) released into the Khoshk River estuary and treated them with the synthetic amine-based odorant morpholine to enhance imprinting of natural river odours and promote homing behaviour, finding treatment at the active fry stage at 0.5-1.0% had the best homing rate, and recapture rate was greater at 6.7% in the treatment period than in a previous five-year period without treatment at 5%. Mohammad Nejad Shamoushak *et al*. (2013) found that the best stocking density for cultured fry was 350,000/hectare. Vahid Farabi *et al*. (2013) studied the effect of salinity and turbidity on survival and changes in gill tissues of juveniles, the gills showing shortening and thickening although survival rate was acceptable. Alijanpour *et al*. (2014) found orange eggs had a higher carotenoid content than green ones and larger fish had more carotenoid content, but fertilisation rate was not affected by carotenoid content. Alijanpour *et al*. (2015) studied egg colours (yellow, orange or green), carotenoid content (highly pigmented eggs had more and this may affect variability of the eggs) and fertilisation rate in migratory fish from the Shirud and Tajan rivers, finding that Shirud fish had less carotenoid, orange and yellow eggs had more carotenoid than green ones, larger fish had more carotenoid, and fertilisation of orange and yellow eggs was somewhat associated with carotenoid content. Bani *et al*. (2014) showed the effects of salinity on levels of cortisol, glucose and sex steroids of fish from the Khoshk River - females from the river matured in March but those held at a salinity <0.5 p.p.t and 8-13 p.p.t. did not ovulate while both wild and captive males spermiated. Farzadfar *et al*. (2014) described the morpho-histology of the male gonad in fish from the Jef River.

Ghahremanzadeh *et al*. (2014) made a cytological comparison of fish from the Caspian Sea (8.49 p.p.t. salinity, 12.4ºC) and the Khoshk River (0.18 p.p.t., 18ºC), brackish water fish having higher Na^+, Cl^-, K^+ and Mg^{2+} ions and osmotic pressure, and larger average size and number of chloride cells. Gheisvandi *et al*. (2014) found how water temperature affected food transit time and digestive enzyme activity in larvae. Gheisvandi *et al*. (2014) showed significant differences in growth and intestine morphology in juveniles exposed to different salinities either abruptly or gradually. Khosravi Bakhtiarvandi *et al*. (2014) studied ontogenetic changes in lipids, fatty acids and body composition from the fertilised egg to larvae 50 days post-hatching, used in order to increase quality and survival by providing the correct nutritional requirements. Sayyad Bourani *et al*. (2014) examined chloride cell frequency and distribution in the gills as well as ions and osmotic pressure of larvae exposed to water of Caspian Sea salinity.

Gheisvandi *et al*. (2015) found noticeable effects on the activity of digestive enzymes in larvae reared with gradual and abrupt salinity changes. Khoshnood *et al*. (2015a) described the structure and ultrastructure of gill chloride cells used in ion transport and thus facilitating migration between salty and fresh environments. Mohseni *et al*. (2015) measured changes in ion, hormone and biochemical factors in fingerlings released into the Tajan River estuary, the normal stocking procedure, with results showing osmoregulatory disorder and failure in salinity adaptation. Ahmadian *et al*. (2016) found that fingerlings could be grown well at 5‰ salinity and 24ºC, although salinity and temperature did not affect survival. Ghanei Tehrani *et al*. (2015) and Ghanei Tehranei (2016) gave physical, chemical and biological properties and pesticide load of the Tagan (= Tajan) and Surkh or Sorkh rivers and found the latter had better conditions for release of fingerlings. Laloei (2016) used the luciferase gene as a genetic marker for detection of this species. Mohiseni *et al*. (2016) examined the effects of fasting on body electrolytes during migration to the sea of juveniles, finding a disruptive effect on success in seawater adaptation. Mohiseni *et al*. (2016) studied feed deprivation on chloride cell development, important in salinity adaptation for this migratory fish, and found a disruptive effect with decreases in gill Na^+, K^+, ATPase activity, and chloride cell diameter, perimeter and area. Rezamand *et al*. (2016) found *b* values of 2.609-3.196 in the length-weight equation for 50 cultured juveniles, showing a range of ecological conditions. Sayyad Bourani (2016) determined the suitable size for releasing cultured fish by evaluation of the osmotic regulation ability. Overall, the results of measuring ions and osmotic pressure on the tenth day of treatment, the osmotic potential of juveniles of 2.5, 5, 10 and 20 g in Caspian Sea water and all groups except the 0.5 g in water of 7 p.p.t., were confirmed. But in the case of unfavorable conditions for the release in estuaries, fish with a weight 1 to 3 g could be released directly to a beach (where the salinity was 7 g/l) and fishes with a weight from 10 to 20 g could be released to the sea. Valipour (2016) studied the effect of rearing density on growth and survival of fingerlings and recommended 25 kutum/sq m in Caspian Sea water. Zakir *et al*. (2016) studied the relationship between lysozyme activity and migration between fresh and brackish water, finding activity greater in skin mucus than in the blood and greater in brackish than fresh water. Hadifar *et al*. (2017) cultured skin cells from fin tissue for use in virology, toxicology and immunology research. Nikghorban *et al*. (2017, 2019) cultured kidney cells, of use in studying oncology, cellular physiology, gene expression, and viral diseases and toxic compounds which readily affect kidney tissues. Omidvar *et al*. (2017) studied fingerlings in aquaculture to determine the natural amounts of white blood liver enzymes and found also that the liver was the target organ of the spring viremia of carp (*Rhabdovirus carpio*). Rahpayma *et al*. (2017) cultured spleen cells as a preliminary to studying diseases and environmental pollutants. Samarin *et al*. (2017) determined survival rates of stripped eggs stored

in ovarian fluid at low temperatures (4 and 7ºC) and found they should be fertilised within 8-12 hours after stripping to give a viability rate above 50%. Fadakar Masouleh *et al*. (2018) studied osmoregulation in juveniles suddenly entering waters of 6 and 11 p.p.t., concluding that indicators reached a desirable point at seven days and release of hatchery fish into the Caspian Sea, where salinity was higher, was preferable as estuarine pollutants would be avoided. Khoshkhial *et al*. (2018) identified *Lactobacillus* species in the gut using DNA where these bacteria produced antimicrobial compounds, enhanced the immune response and increased nutrient availability. Valipour and Maghsoodieh Kohan (2018) studied stocking density in concrete ponds on growth and survival of fingerlings in Caspian Sea water and found a density of 455 g/sq m was the most suitable.

Bani *et al*. (2020) studied the spawning migration of five-year-old reproductive and non-reproductive female kutum using the trace elements barium, calcium and strontium in their otoliths as a means of differentiation. Small differences in the concentration of strontium and significant differences in the barium:calcium ratio were found and the latter could be the result of fish migration towards the coastal zones over the reproductive season and feeding of non-reproductive individuals in estuarine areas. Shakoori *et al*. (2021) investigated the abundance of microbenthos *(sic*, macrobenthos) as natural food in the ponds of the Shahid Rajaie Center, Mazandaran and found that the percentage of macrobenthos in pond 1 was Lumbricidae (81.3%), Chironomidae (8.8%), Tubificidae (6.8%) and Baetidae (2.9%) and in pond 2 was Lumbricidae (79.9%), Chironomidae (14.8%) and Tubificidae (5.2%). Lumbricidae and Chironomidae, which are resistant families, had the highest presence in both ponds. These earthen ponds had good potential for aquaculture and could provide part of the live food needed by juveniles from natural production.

Chemical composition and food safety:-

Ershad Langroudi (2004) studied the durability and levels of polycyclic aromatic hydrocarbons in relation to the lipid content of smoked common carp, finding less than in *Hypophthalmichthys molitrix* and in the clupeid *Alosa caspia* (Caspian shad). Hosseini *et al*. (2005) recorded changes in condition and appearance of fish stored on ice for 1-20 days, showing gradual deterioration in quality with appearance excellent to good until the fourth day and good to acceptable until the tenth day. Razavilar and Tavakoli (2006) studied the prevalence of the human toxigenic bacterium *Clostridium botulinum* and the need for food safety control measures. Jalili (2007) documented protein changes and fatty acid deterioration as influenced by cold storage time. Babazadeh *et al*. (2008, 2008) reported on the changes in chemical, organoleptic and nutritional factors in fish stored at -18°C for up to 120 days, 80 days being ideal. Ghanbari *et al*. (2009) investigated production of a bacteriocin or antibacterial from intestinal bacteria of this fish species. This bacteriocin had potential for use as a biopreservative for food. Hedayatifard and Nemati (2009) salted roe which acted to conserve it, and also by decreasing the fat content helped to preserve omega-3 and omega-6 fatty acids. Hosseini *et al*. (2009) found a lower temperature (-18°C) reduced spoilage and total volatile base nitrogen was the best indicator for quality control rather than microbial indicators. Safari *et al*. (2009) recorded the lipid and protein composition of muscle in different maturity stages from January to April but found no significant differences.

Babakhani *et al*. (2010) studied the effect of cooking methods on the proximate composition and fatty acid profile of raw, baked and fried fish with baked fish the most valuable dish for human consumption requirements. Ghomi *et al*. (2010) found no significant effect of photoperiod on gut bacterial load in juveniles. Mirshekari *et al*. (2010, 2011) measured the effect

of the bacteriocin nisin Z and sodium benzoate which improved shelf life of vacuum-packed fillets at 4°C. Rohollah Javadian (2010) determined the effect of different thawing methods (in a refrigerator, water, air or microwave) on quality, finding the lowest adverse chemical and biochemical values, as well as microbial growth, in water-thawed samples. Velayatzadeh *et al*. (2012) examined levels of drip, drip protein and total volatile base nitrogen (TVB-N) as measures of spoilage of fish kept refrigerated at -18°C with various salt levels, the highest drip and drip protein being in 5% salt in this species among four examined. Anvari *et al*. (2013) concluded that gutting of kutum before cold smoking was recommended as pre-treatment for storage at room temperatures as there was less bacterial spoilage and oxidation. Khorramgah and Rezaei (2013) examined various chemical and sensory properties of frozen fish and found an acceptable quality over six month's storage. Rabiei *et al*. (2013) found ajowan oil (from the herb carom or *Trachyspermum ammi*) significantly reduced bacterial growth (*Listeria monocytogenes*), more so in fish broth medium than fillets. Rezaei *et al*. (2014) identified and extracted polycyclic aromatic hydrocarbons from smoked fish and found acceptable levels of them and of the bacterial community, and fatty acid levels were suitable.

Kaseb and Kalbassi (2015a, 2015b) studied the toxicity of colloidal silver nanoparticles and their effects in allowing an increase in skin bacterial flora. Pourashouri *et al*. (2015) described chemical and microbiological changes that occurred when roe was salted (protein and moisture content were less than raw roe, for example), but salted roe had inhibitory effects on bacterial and yeast growth. Raoofi *et al*. (2015) recorded changes in chemical and microbiology of fish stored in ice for up to 16 days where beach-seined fish were of better quality than gill-netted fish. Hedayatifard and Pourmolaei (2016) showed that smoked fish from northern Iranian markets had acceptable chemical indices, nutritional values and microbial communities, and valuable fatty acids were preserved. Mirshekari *et al*. (2016) found that the simultaneous use of nisin Z and sodium benzoate could increase the shelf life of vacuum-packed fillets stored at 4ºC by their antimicrobial and antioxidant properties. Motallebi *et al*. (2017) found that salted roe coated with chitosan and natamycin at 10 mg/kg increased shelf life. Zand *et al*. (2017) examined the use of modified atmosphere packaging (gas mixtures, carbon dioxide, nitrogen and oxygen, and vacuum) and multi-layer flexible films on the pH and therefore shelf-life of smoked fish. Amini Khahan *et al*. (2018, 2019) compared quality and shelf life, and sensory and appearance changes, between gill-netted fish caught alive and dead in the net, finding quality and shelf life, colour hue, hardness and chewiness, texture, appearance of gills, and sensory evaluation were significantly different and live fish were preferable. Mehdipour *et al*. (2018) found that the heavy metal content (cadmium, chromium, lead) in this species decreased with various cooking methods such as boiling, grilling and microwaving. Hasebi *et al*. (2019) extracted and purified trypsin from the intestine and found it more kinetically effective than commercial trypsin.

Naderi Gharagheshlagh *et al*. (2020) isolated acid-soluble collagen from the skin of this species for commercial use as other sources, such as bovine and pig skin and chicken waste, had religious and biological contaminant restrictions in Iran.

Disinfection and healing:-

Farokhroz *et al*. (2013, 2014) examined the effects of formalin and copper sulphate, used to treat parasitic and bacterial infections in aquaculture, on skin and gill tissues, finding increasing damage with increasing dosage. Nodeh and Hoseini (2013) investigated the toxicity of potassium permanganate, used as a biocide and disinfectant in aquaculture, the LC_{50} 96 h being 3.204 for 1 g fish and 3.46 for 3 g fish, kutum being susceptible to permanganate toxicity.

Hormones and immunology:-

Heidari *et al*. (2010) found the steroid hormones estradiol-17β and testosterone were functionally important during the vitellogenic stage of oocyte development while progestogens were probably associated with the maturational phase of ovarian growth. Ahmadinejad *et al*. (2013) assessed the effects of the hormone LHRAH-A2 alone and in combination with the dopamine antagonist pimozide on spawning and reproductive quality indicators in broodstock, finding the combination economical and useful in the field. Ahmadnezhad *et al*. (2013) assessed changes in gonad development and sex steroid hormones in broodfish after induction with various hormone treatments (LHRH-A2 alone and in combination with dopamine antagonists pimozide and chlorpromazine), showing variations in both with each treatment.

Koohilai *et al*. (2015) evaluated the effects dopamine antagonists and adrenergic agonists and antagonists on plasma levels of 17β-estradiol and 17α-hydroxyprogesterone finding an inverse relationship between the dopaminergic and adrenergic systems. Bani *et al*. (2016) found sexually mature female fish held in saline conditions showed suppressed steroid hormones resulting in failure of gonad development while male fish adapted well and showed synchronicity in steroid hormone variations with wild fish, resulting in testicular development. Sudagar *et al*. (2016) compared ovaprim, ovafact and pituitary extract on artificial reproduction of female brood stocks, finding the former was best on the basis of ovulation rate, availability and lower cost. Heidari and Farzadfar (2017) found lysozyme levels in the head kidney, spleen and liver tissues of male and female fish declined from October to March coinciding with the lowest sea surface temperature rather than gonadal growth, increasing in April and May. Koohilai *et al*. (2017) evaluated the effects of third generation dopaminergic and adrenergic agonist and antagonist pharmaceutical compounds with GnRHa (gonadotropin releasing hormone stimulating follicle release) and ovaprim on 17β-estradiol and 17α-hydroxyprogesterone levels in plasma, the dopaminergic system inhibiting reproduction while the adrenergic system stimulated it. Koohilai *et al*. (2017) evaluated a range catecholaminergic pharmaceutics in various combinations for ovulation and spawning induction, finding ovaprim (a commercial spawning inducing agent) treatment had the highest mean value of ovulation success, ovulation index, fertilisation success, relative fecundity and number of eggs. Mohammadrezaei *et al*. (2017) showed that the natural phytoestrogens genistein and β-sitosterol reduced reproduction performance in the long term, disrupting the function of the endocrine system. Mohammadrezaei (2018) and Mohammadrezaei *et al*. (2018) noted that vitellogenin gene expression could be used as an indicator to determine the altering effect of estrogenic plant compounds. The effects of genistein and β-sitosterol were examined and it was found that gene expression was higher in the liver of fish exposed to genistein at 500 ng/l than a control or β-sitosterol. Steroid biosynthesis was altered and enzyme activity disturbed such that the population structure and reproduction performance could be reduced over time. Hadifar *et al*. (2019) produced a possible permanent cell line from caudal fin tissue of this fish. Tolouei Nia *et al*. (2019) carried out a basic study on the biochemical characteristics and activity of lysozyme, an antimicrobial enzyme of the immune system, and found some phenomena such as water hardness and warming could exert negative effects on the innate immunity of the fish.

Ghorbankhah and Bani (2020) noted that females display different egg colours (green and orange) during the spawning season, mostly due to the presence of carotenoid pigments and there was a positive influence of this egg carotenoid on post-fertilisation stages, such as elevating the innate immune parameters in larvae. Sarpanah *et al*. (2020) found cortisol treatment with subsequent ovaprim injection decreased plasma sex steroids and increased oocyte cortisol

content in wild confined broodstocks subjected to short-term confinement stress but had no effect on oocyte histological characteristics. Valipour and Heidari (2021a) studied the effect of different concentrations of kisspeptin (5, 20, 50 and 100 µg/kg of body weight) that stimulates the production and secretion of GnRH in the hypothalamus of the brain and is required for normal maturation and reproduction. The reproductive hormones 17-α-20-β-dihydroxy-4-prgnen-3-one (DHP) and 17-β-estradiol (E2) were measured eight hours after injection. The secretion of reproductive hormones changed significantly at different concentrations of kisspeptin.

Spermatology:-

Takeh *et al*. (2008) studied the ratio of ions (Na^+, K^+, Ca^{2+} and Mg^{2+}) on semen biological characteristics (and therefore selection of suitable quality sperm in aquaculture), the ratios variously affecting sperm duration, haematocrit, total protein and glucose, and each other. Takeh *et al*. (2009) compared spermatological and biochemical parameters of semen at different broodstock migration times, some varying significantly (e.g., sperm movement duration, spermatozoa motility and K^+) while others did not. Tekeh and Imanpour (2009) examined males with less than 110 head tubercles, 110-135 tubercles and more than 135 tubercles for various seminal characteristics finding, for example, correlations with sperm duration, spermatozoa motility and K^+ of seminal plasma but not other characteristics, some evidently changing during maturation and others remaining constant.

Bavand Savadkohi *et al*. (2012) examined age (2-6 years) and efficiency factors (sperm characters, fertilisation and hatching rates) for artificial propagation of spawning males in the Shirud, finding four-year-olds were economically the best choice. Esfandyari *et al*. (2012) found sperm motility varied among males and in different ovarian fluids, some males thereby having faster sperm overall. Gharache and Paighambari (2012) showed fish caught in gill nets had better spermatocrit levels than those taken by beach seine, but no difference in semen volume and sperm movement. Fadakar Masouleh (2014) noted how low levels of kraft liquor from the wood and paper industry affected testicular development and sperm quality. Fallah Shamsi and Khara (2015a) studied spermatological characteristics in 3- and 4-year-old fish from the Sefid River and found osmolality, mobility percentage and duration and compaction were positively correlated with fertilisation percentage and hatching rate in artificial propagation. Fallah Shamsi *et al*. (2015) examined fish at the Shahid Ansari Bony Fishes Propagation Center and found a significant correlation between osmolality, mobility percentage, mobility duration and compaction of sperm with parameters of artificial propagation efficiency such as fertilisation percentage and hatching rate. Binaii (2016) and Binaii *et al*. (2016) evaluated sperm quality before and after cryopreservation showing a significant decrease in motility although those samples diluted with glycerol were motile while those in ethylene glycol were immotile. Golpour *et al*. (2016) found that ovarian fluid significantly influenced sperm motility (duration) and percent motility (progressive forward motile sperm), although the full mechanism was still unknown. Rajabi Islami *et al*. (2017) found that fork length and body height could be used as indices of sperm density and spermatocrit while weight had no correlation in 3-4-year-old males. Tehranifard *et al*. (2018) detailed changes in blood, immunity, ions and testicular tissue in relation to age in winter and spring in the Chaf and Chamkhaleh rivers of Gilan. Hormone levels were consistent with testis development, reaching the highest level for progesterone in May in 4-5-year-olds, for example. Akbari Nargesi *et al*. (2021) found chilled storage of semen up to 48 hours can facilitate the management of artificial insemination in hatcheries.

Haematology:-

Afkhami *et al*. (2011, 2014) surveyed ionic and metabolic factors of blood serum, of use in reproduction and farming management of this species. Shafiei Sabet *et al*. (2011d) examined blood ionic and metabolic indices in mature and maturing females, useful in enhancing breeding, culturing and restocking. Darvish Bastami *et al*. (2012) studied ionic (Na^+, K^+, Mg^{2+} and Ca^{2+}) and metabolite (cholesterol, total protein, glucose) factors of blood serum during the spawning migration, useful in improving the management of reproduction and cultivation. Khara *et al*. (2012) examined broodstock migrating into the Tajan River and found no differences in a wide range of blood parameters except for neu (neutrophils presumably) between age groups and mon (presumably monocytes) between sexes. Firouzbakhsh *et al*. (2013) compared blood factors in male and female broodstocks from the Tajan and Shirud rivers, results suggesting male and female variations in these factors should be taken into account when used to assess sex, age and spawning.

Azarin *et al*. (2015) examined the effects of different levels of iron and the probiotic BioPlus-2b on fry blood parameters, finding 7 mg/kg of iron in feed and 1.6 x 10^9 probiotics continuous flow culture resulted in the highest amount of red blood cells, haemoglobin, haematocrit, mean corpuscular volume, mean corpuscular haemoglobin and lymphocytes.

Stress:-

Nikoo *et al*. (2012) recorded blood parameters of adults in relation to sex, size and maturity as monitors of stress and pathological changes. Nikoo and Falahatkar (2012) examined physiological responses in wild broodstock subjected to physiological stress (crowding) during transport. Behrouzi *et al*. (2014) found that heavier juveniles better survived a range of salinity in a laboratory setting although kidney tissues were affected under salinity stress. Gharache *et al*. (2014) measured blood and biochemical parameters which differed with stress of capture methods such as beach seines and the more stressful gill nets.

Ghiasvand *et al*. (2017) found that fry fed 1% garlic powder (*Allium sativum*) had the highest survival index after 48 hours exposed to salinity stress (15 p.p.t.) as well as improved growth performance and body composition. Ahamdi *et al*. (2019) showed that fish caught in gill nets were acutely and lethally stressed, especially at higher temperatures, and fish perished after 18 hours entanglement. Sarpanah (2019) investigated the effect of captivity stress in fibreglass tanks on reproduction and found a reduction in hormone levels.

Anaesthesia:-

Babaeeinezhad *et al*. (2013) compared stress levels when the anaesthetics clove extract, lidocaine and sodium bicarbonate were used with male fish, finding that a combination of clove extract and lidocaine had less stressful effects than other treatments. Babaiinezhad and Bahrekazemi (2019) showed that sodium bicarbonate was not a suitable anaesthetic for brood stock because of irreversible stressful effects while lidocaine, and then clove extract, were recommended as suitable especially for females.

Conservation. Azari Takami *et al*. (1990) listed the following reasons for a decline in the commercial catch of this species:- a) regression of the Caspian Sea which decreased the surface area of the Anzali Lagoon and increased the growth rate of aquatic vegetation, b) mechanisation of farming and a consequent increased demand for irrigation water leading to reduced river flows during the spawning migration, c) use of fertilisers and pesticides in rivers draining into the Anzali Talab (and pesticides and herbicides such as diazinon, malathion, machete and saturn had a highly toxic effect on fingerlings of this species (Piri *et al*., 1999) and the herbicide butachlor reduced sperm volume and increased abnormal sperm (Lasheidani *et al*., 2008)), for example among others), d) pumping of river water for irrigation causing mass mortalities of fry, e)

industrial development increasing the pollution load, and f) excessive catches of adults to the extent that all spawners in a river were taken. Emadi (1979) and Rabazanov *et al*. (2019) added such factors as road construction and the removal of sand and gravel from banks and river beds, habitat degradation, erosion caused by felling trees and shrubs along river banks and in the mountains construction of bridges and dams and raising of their substructures which formed barriers to migration, illegal fishing, and climatic changes. Illegal fishing and non-standard nets threatened the stocks while fingerling release (120-140 million) and improvement of natural spawning areas through rises in water level contributed to stock increases (*Annual Report*, *1995-1996, Iranian Fisheries Research and Training Organization, Tehran*, pp. 19-20, 1997). Three million fingerlings weighing 3-5 g were released into the Anzali Lagoon or Talab (*Iranian Fisheries Research Organization Newsletter*, 49:4, 2006). Poaching was rampant, even on the spawning grounds, and was also a significant factor in decline of this species (RaLonde and Walczak, 1972). Yahyaei *et al*. (2019) noted that Miankaleh, Golestan beach seines caught fish below standardised sizes.

In the 1970s, rivers were rented to fishermen to exploit to an unlimited degree such that all spawning fish were taken and there was no recruitment for four years (Carl Bond Archives, Oregon State University, Corvallis).

The catch declined from 5,854 t in 1918 to 172 t in 1937. Actual catches were about 20-30% larger because of local sale and consumption (Emadi, 1979). RaLonde and Walczak (1970b) noted a decline from 1,556 t in 1957 to 162.1 t in 1967 so the catch did not decline evenly. Aminian Fatideh and Shafiei Sabet (2011) noted that the beach seine size of fish was 55 cm 80 years before but was 37 cm in 2007. Emadi (1979) also pointed out that intensive sea fishing and fishing in rivers hindered spawning of the winter form, and led to a situation where only the spring form spawned. Leasing of rivers to fishermen was discontinued in an attempt to alleviate the decline in this species. The migration distance up rivers decreased from about 25 km to about 8 km in recent years because of water abstraction and dams for agriculture (Bartley and Rana, 1998b). However, Yousefian and Mosavi (2008) reported that artificial stocking had increased catches from 1,000 t in 1981 to 10,000 t in 2002. Chakmehdouz Ghasemi *et al*. (2009) reported a catch of 17,000 t in 2008. Aghili and Mohammadi (2012) found a catch per unit effort using research nets was 0.17 kg/net/day in Gorgan Bay. Pourasdi *et al*. (2017) documented a reduction in catches in the Gilan rivers Chalwand, Lamir (= Lomir), Hawiq (= Haviq), Nawarud (= Navrud or Nav) and Khalehsara from a total number of male and female fish caught in 1386 (21 March 2007-19 March 2008) at 22,130 along with 1,031 kg of eggs, to 7,052 males and females and 494 kg of eggs in 1395 (2016-2017), and 2,814 males and females and 141 kg of eggs in 1396 (2017-2018). Problems affecting numbers of fish were given as uncontrolled harvesting of sand, deepening of the river bed, increasing water salinity due to sea invasion, deformation of the spawning sites, the effects of fine particles and sediments on the respiration of fish and food insects, and the effect of zinc pollution.

A further problem was the restocking programme only took spring-run fish; the fall-run stock may no longer exist (but see below). Valipour and Khanipour (2015) stated the autumn (or fall) form was near extinction. In addition, stocks from various rivers were mixed and may result in outbreeding depression, the loss of adaptations to specific rivers in terms of migration patterns, spawning time, behaviour and other factors (Bartley and Rana, 1998b). Chakmehdouz Ghasemi *et al*. (2009) noted that the spring run comprised over 98% of the catch and that the autumn run stock has declined from deterioration of spawning grounds, overfishing and other factors.

Fazli *et al*. (2013) examined changes in mature females for the periods 1948-1950, 1974 and 2007 in Iranian waters. The average fork length decreased from 54.1 to 44.7 to 43.9 cm (or 40.0 in the text) and average weight from 2,181 to 1,295 to 1,210 g. However, the average condition factor had remained fairly constant between 1.35 and 1.38. Potential fecundity declined from 106,800 to 74,600 to 64,400 eggs. The reduction in fecundity was a consequence of a shift to smaller fish size. Artificial propagation was extensive and this resulted in smaller fish maturing earlier and ovulating sooner than larger fish.

Karimzadeh *et al*. (2014) examined samples from gillnet cooperatives in Tonekabon in the southwest Caspian Sea where this species comprised 69% of the total catch. The catch per unit effort was 220 kg and showed a remarkable increase over the past decade but qualitative changes in stocks were observed such as length, weight and age.

Measures to combat loss of this valued fish included a ban on fishing in the Anzali Talab and its tributary rivers (catches here were up to 1,000 t per year (Emadi, 1979)), effective control of illegal fishing and artificial spawning experiments (although the latter were insufficient to replace stocks). For several years starting in 1925, artificial breeding raised larvae for release in the 10 most important rivers. In 1976-1977, fingerlings were raised to increase the stock in the Caspian Sea. Over 5 million fry were produced by the Havyg (Haviq) Hatchery alone in 1977. Mesh size of nets used to catch this species were apparently not harmful to younger fish as these had a chance to escape from the wings, with a wider mesh, before the bag net, with a smaller mesh, came into play (Afraei Bandpei *et al*., 2010).

Emadi (1979) recorded releases of 28-44 million fingerlings and 250 million larvae “in recent years”. A farm in the Siah Kal region of Gilan Province near Rasht was expected to produce 40 million white fish “roe”, presumably fry, in 1985 (*Kayhan International*, 20 May 1984). The Dr. Beheshti Hatchery near Rasht expected to release more than 60 million fingerlings in the Iranian year 1993-1994 (*Abzeeyan*, Tehran, 4(5):VI, 1993). This hatchery had a peak production for the period 1973-1993 of over 140 million fingerlings in 1989, rising from the low period of 1973-1982 with less than 10 million fingerlings, and with subsequent decreases to about 50 million fingerlings in 1993 (*Abzeeyan*, Tehran, 5(3 & 4):IX-X, 1994). The number of fingerlings released from 1986 to 1991 climbed from 38 million to 170 million (Holčík and Oláh, 1992). Krasznai (1987) also referred to propagation of this species at Sad-e Sangar (Dr. Beheshti) and Siah Kal Fish Farms near Rasht in Gilan. Emadi (1993a) gave fingerling production at government hatcheries as follows:- 25.3 million in 1983, 28.3 million in 1984, 38.0 million 1985, 51.7 million in 1986, 72.0 million in 1987, 84.3 million in 1988, 140.2 million in 1989, 156.3 million in 1990, 110.0 million in 1991, and 145.0 million in 1992. The Shahid Rajaei Hatchery in Sari released 358 million fingerlings, possibly in a single year (*Abzeeyan*, Tehran, 4(7):VII, 1993), although 70 million were reported as released annually to Mazandaran rivers in 1995 (*Abzeeyan*, Tehran, 6(8):III, 1995) and production of 70 million kutum fingerlings annually was reported in 2001 (*Iranian Fisheries Research Organization Newsletter*, 28:3, 2001). In 1997, 142 million fingerlings were produced for restocking (Bartley and Rana, 1998b). In 1999-2000, 150 million juveniles were released into the Caspian Sea (*Iranian Fisheries Research Organization Newsletter*, 23:4, 2000). From October to March 2000, 80 million juveniles raised in the Shahid Ansari aquaculture and breeding centre in Gilan were released into the Caspian Sea and neighbouring water bodies (*Iranian Fisheries Research Organization Newsletter*, 26:2, 2001). Billard and Cosson (2002) cited a mean of 100 million alevins released per year, reaching 140 million in some years, and gave a brief overview of production facilities. Amini (2006) reported release of fingerlings into the Larim, Goharbaran, Shirud, Tonekabon,

Sardab, Mirud, Babol, Asbuchin and Sorkh rivers in 2000-2001 numbering 53.7 million and 62.5 million. Fork length was 36.7 mm and 43.3 mm and condition factor 1.13 and 1.2 respectively by year. In 2006, a report had more than 150 million juveniles being released into the Caspian Sea every year (www.iranfisheries.net, downloaded 28 July 2006). Sources obviously conflicted on exact numbers, nevertheless marked variations in production were evident over short periods. The South Caspian Fisheries of Azerbaijan also released larvae in Soviet waters, more than 150 million in 1983 for example (Zarbalieva, 1987). Abdolhay *et al*. (2011) gave figures for fingerlings released in Iran as 225 million in 2002, 155 million in 2003, 179 million in 2004, 229 million in 2005, 174 million in 2006, 262 million in 2007, and 187.1 million in 2008. The catch in the years 2002 to 2008 was 6,417 t, 8,984 t, 7,036 t, 9,631 t, 16,117 t, 17,196 t and 14,835 t respectively. Fazli and Daryanabard (2020) assessed the desirable levels of the kutum for stock enhancement with two scenarios using fingerlings released (FR) and recruitments (R) density-dependence and macrobenthic production (P). In the years 1989-2018, the FR increased from 72 million in 1989 to 400 million in 2009 and then declined to 176 million in 2018. In contrast, the R with a lag of two years declined from 44.53 million in 1991 to 25.77 million in 1998, increased to 65.07 million in 2005, and then collapsed to 25.01 million in 2018. Based on FR-R relationships of Ricker and segment regression models, the lowest level of FR, which resulted in the highest R (39 million), was about 200 and 150 million fingerlings, respectively. Based on the P/biomass ratio of macrobenthic species, the annual production was 241.6 thousand mt. The desired number of fingerlings concerning stock enhancement should be lower than 150 million to prevent overcompensation in the Iranian waters of the Caspian Sea. Karami Rad *et al*. (2021) reviewed the release of over 5.6 billion juveniles for the three decades 1970-1980-1990 with a catch of over 305 thousand tons.

The Inland Water Aquaculture Research centre in Anzali has artificially propagated the autumn or fall-run stock (www.iranfisheries.net, downloaded 28 July 2006). Three million fish were released in July 2006, probably at 3-4 g with more to be released at a heavier weight. Valipour (2010) and Valipour and Khanipour (2015) caught brooders of the fall form from the entrance to the Nahang Roga in the Anzali Wetland and held them in floating cages there and in earthen ponds at the Sefidrud Fisheries Research Station. There were no significant differences between the two maintenance statuses in maturation period and other reproductive characteristics. The male:female ratio was 1:1.4, minimum and maximum weight was 1,450 g and 3,100 g, brooders injected with carp pituitary extract showed absolute, practical and relative fecundities of 88,565, 73,805 and 48,670 eggs, incubation lasted 7-10 days at 14-16ºC, larvae were introduced to earthen ponds at 3 million/ha and were cultured for 3-4 months, and 1.8 million fingerlings at 1-2 g were released into the Anzali Wetland.

Azari Takami *et al*. (1990), Woynarovich (1985) and Bartley and Rana (1998b) detailed the technique for artificial spawning, incubation and raising of fingerling mahi sefid or kutum. Adults were caught as they entered rivers on the spawning migration by blocking the river with wooden tripods interlaced with twigs as screens and using a meshed net. The Shaeed Ansari Fish Farm (of Shilat, the Iranian Fisheries Company) took fish from five main rivers, forming a brood stock of 10,000 females and 20,000 males (Bartley and Rana, 1998b). Almost 100% of migrating fish were caught. Ripe fish were stripped and the eggs fertilised with sperm. Eggs from two females were pooled and mixed with milt from two males. The adhesive layer was washed away with water and continuous stirring. Once the eggs were completely separated from each other they were placed in incubator jars. Eggs may be placed in net-bottomed trays in the river for two days before being sent to a hatchery. Egg development took a minimum of seven days but larval

development only took 1-2 days. Larvae were fed with a mixture of milk and eggs until they were five days old and then put in the earthen rearing ponds. In the Shaeed Ansari Fish Farm, fingerlings were released in a river mouth at 1 g and most entered the Caspian Sea within three days (Bartley and Rana, 1998b). Fingerlings were grown in ponds to a weight of 2-3 g and then released in the Sefid River which carried them down to the sea (Petr, 1987). Production of 1-2 g fingerlings attained 3 tonnes per hectare in fish farms (Emadi, 1993a). Farabi *et al*. (2007) studied brood stocks and fingerlings in the Shirud, Tonekabon, Tajan and Goharbaran rivers from March 2004 to March 2005. The mean length, weight and condition factor for broodstock females and males were 43.75 and 36.5 cm, 1,189.5 and 678.13 g and 1.42 and 1.38 respectively. Eggs collected over a 62-day period weighed 4,931 kg, mostly at the end of March and beginning of April. Percentage of survival of eggs in the four rivers listed above was 94.5, 95.1, 87.7 and 96.9 respectively. Newly hatched larvae averaged a total length of 6±2 mm and a weight of 2±0.2 g. The number of fish produced at less than 1g was 16,942,454 representing 19.9% of the total released in Mazandaran in 2004. Fish in the 1.0-1.5 g weight class, suitable for release, numbered 62,905,247. Parasites of fry were *Diplostomum*, *Dactylogyrus*, *Butriocephalus*, nematodes, *Trichodina* and *Epistelis*.

Haghi Vayghan *et al*. (2013) used habitat suitability index modeling to describe the relationship between abundance and ecological variables, both remotely sensed and field data. A geometric mean model explained the relationship when the variables depth, benthos biomass, photosynthetically active radiation and sea surface temperature were used. Depth and substrate were the most important field data for kutum to select its habitats and chlorophyll *a*, photosynthetically active radiation and sea surface temperature were the most critical remotely sensed data for near real-time prediction of the habitat.

The hybrid with grass carp reached an average weight of 100 g and a length of 22 cm after 5 months in the first report cited above under **Systematics** and 6.7 g and 9.17 cm after 4 months in the second report. Larvae were fed live food twice a day and hybrids larger than fingerling size ate grass. The hybrid phenotype resembled the sefid mahi but was an herbivore. It was expected that this hybrid would be used as a new culturable “species”.

Masompour *et al*. (2018) found this species in ghost nets in the Caspian Sea between Babolsar and Sorkh Rud over 200 sq km of Mazandaran coastline. A total of 515 gillnet panels were removed with an estimated total length of 30.9 km and an average mesh size of 80 mm. It was the second most caught species in fall of 12 recorded at 15 fish and the second of 10 recorded in winter at 171 fish. *Alosa caspia* was the most often caught species at 51 fish in fall and 187 in winter. Higher catch rates in winter were attributed to migrations from the northern to the southern Caspian Sea and in shallower water to illegal fishing and loss of nets there.

A fine of 1,500 rials was imposed specifically for illegal angling of this species (Anonymous, 1977-1978).

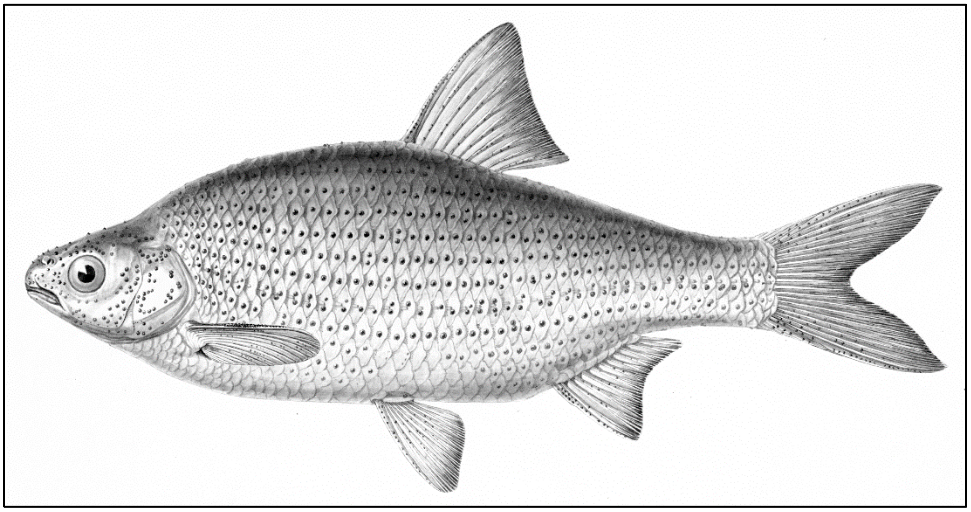
Robins *et al*. (1991) listed this species (as *Rutilus frisii* and presumably including this taxon) as important to North Americans. Importance was based on its use in aquaculture and as food. Kiabi *et al*. (1999) considered this species to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included commercial fishing, sport fishing, abundant in numbers, habitat destruction, widespread range (75% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. The 2000 IUCN Red List listed this species as DD (Data Deficient) but was later listed as of Least Concern. Coad (2000), using 18 criteria, found this species to be one of the top four threatened species of freshwater fishes in Iran. *Mnemiopsis leidyi*, the invasive ctenophore, reduced the biomass of this fish in Iranian

waters (Fazli *et al*., 2015).

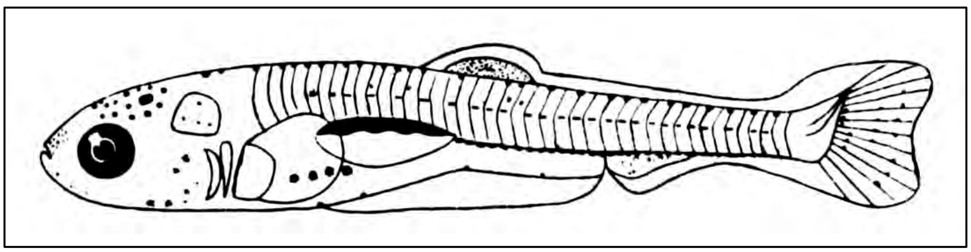
Sources. Iranian material:- CMNFI 1970-0506, 4, not kept, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0509, 1, not kept, Gilan, Sefid River at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0510, 1, 49.3 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0512, 3, 44.2-53.2 mm standard length, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0513, 9, 51.1-66.1 mm standard length, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0514, 4, 53.5-66.5 mm standard length, Gilan, Shafa River estuary (37º55'N, 49º09'E); CMNFI 1970-0516, 27, 42.3-61.0 mm standard length, Gilan, Lomir River (38º14'N, 48º52'30"); CMNFI 1970-0518, 9, 43.4-60.7 mm standard length, Gilan, Haviq River estuary (38º10'N, 48º54'E); CMNFI 1970-0519, 9, 42.8-52.4 mm standard length, Gilan, Chelvand River (ca. 38º18'N, ca. 48º52'E); CMNFI 1970-0520, 19, 46.7-73.9 mm standard length, Gilan, Astara River (ca. 38º25'N, ca. 48º52'E); CMNFI 1970-0521, 1, 52.1 mm standard length, Gilan, Sefid River near Lulaman (no other locality data); CMNFI 1970-0522, 2, 49.7-67.9 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0526, 4, not kept, Gilan, Sefid River below Astaneh Bridge (37º19'N, 49º57'30"E); CMNFI 1970-0544, not kept, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0563, 24, 40.8-58.1 mm standard length, Gilan Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0565, 3, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1970-0568, 1, not kept, Gilan, Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0587, 1, 57.4 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0590, 1, not kept, Mazandaran, Shesh Deh River near Babol Sar (ca. 36º43'N, ca. 52º39'E); CMNFI 1979-0088, 1, 104.3 mm standard length, Gilan, Sefid River (no other locality data); CMNFI 1979-0265, 3, 39.2-45.0 mm standard length, Gilan, head of Anzali Talab at Abkenar (37º28'N, 49º20'E); CMNFI 1979-0470, 8, 30.2-38.9 mm standard length, Mazandaran, stream 21 km west of Alamdeh (36º35'N, 51º43'E); CMNFI 1979-0471, 1, 106.0 mm standard length, Mazandaran, Caspian Sea 14 km west of Alamdeh (36º35'N, 51º48'E); CMNFI 1979-0473, 1, 46.5 mm standard length, Mazandaran, Babol River (36º38'N, 52º38'E); CMNFI 1979-0494, 1, 36.1 mm standard length, Mazandaran, Talar River tributary (36º21'N, 52º51'30"E); CMNFI 1979-0685, 6, 45.2-50.5 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0686, 30, 42.8-52.2 mm standard length, Gilan, Sefid River above ferry (37º24'N, 49º58'E); CMNFI 1979-0696, 39, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1980-0116, 4, 50.8-58.8 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0132, 2, 45.6-48.7 mm standard length, Gilan, Sefid River at Kisom (37º12'N, 49º54'E); CMNFI 1980-0135, 8, 45.7-54.5 mm standard length, Iran. Caspian Sea basin (no other locality data); CMNFI 1980-0138, 4, 45.7-48.7 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1980-0140, 1, not kept, Gilan, Astara Talab close to sea (ca. 38º26'N, ca. 48º53'E); CMNFI 1980-0159, 1, 117.0 mm standard length, Gilan, Caspian Sea at Kazian Bridge (37º28'30"N, 49º28'E); CMNFI 1980-0160, 1, 88.5 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 1980-0908, 24, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1993-0140, 2, 64.5-71.5 mm standard length, Mazandaran, Tirom River, Ramsar (36º51'48"N, 50º48'E); CMNFI 2008-0114, 2, 39.7-42.0 mm standard length, Gilan, Talebabad Anzali (37º26'N, 49º34'E).

Comparative material:- BM(NH) 1879.11.14:31-32, 2, 410.0-430.0 mm standard length, Russia, Astrakhan (ca. 46º24'N, ca. 48º05'E).

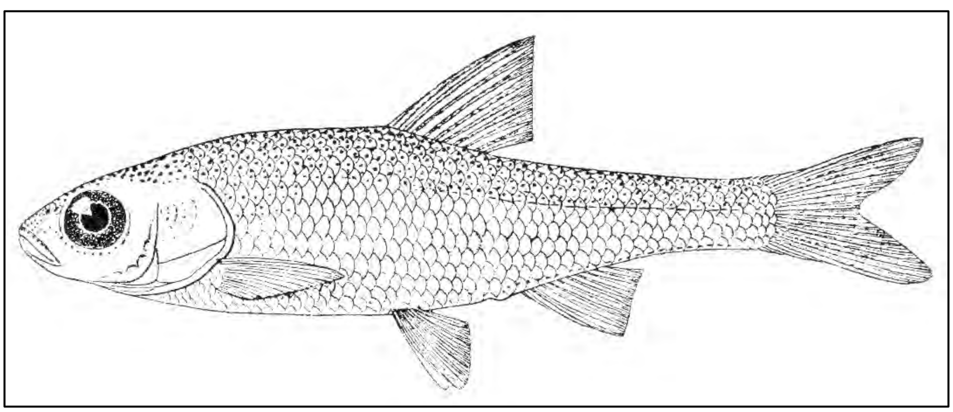
Rutilus lacustris
(Pallas, 1814)



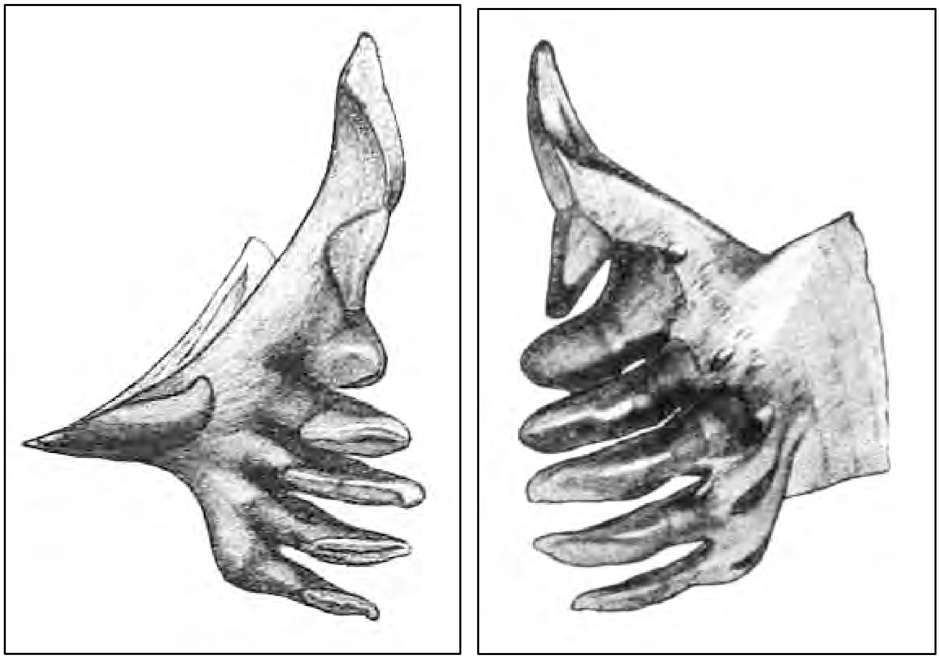
Rutilus lacustris (as *R. rutilus caspicus*) with tubercles, 30+ cm total length, western coast of the Caspian Sea, after Berg (1948-1949).



Rutilus lacustris (as *R. rutilus caspicus*) fry, 9 mm, age two weeks, Russia, Volga River delta, after Kazanskii (1915).



Rutilus lacustris (as *R. rutilus caspicus*), young, 24 mm total length, Kazakhstan, delta of the Ural River, after Shukolyukov (1932).



Rutilus lacustris (as *R. rutilus caspicus*), left pharyngeal arch,
inner view on left, outer view on right, after Berg (1916).

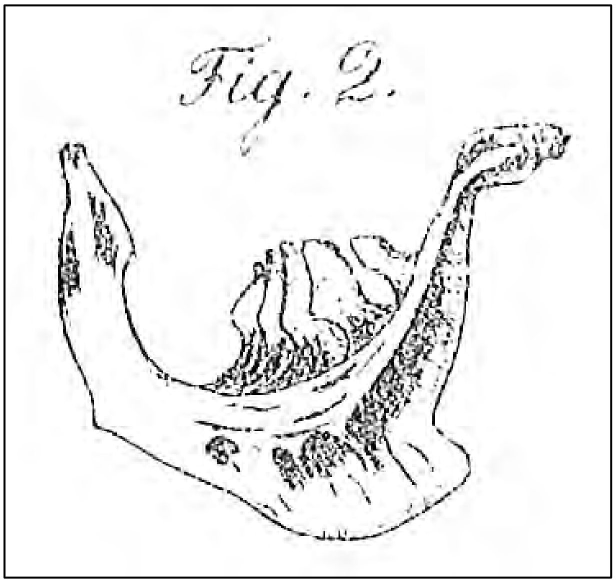
Rutilus lacustris, Iran, Keyvan Abbasi.

Common names. Kolme, kollme, kolmeh, koolmeh or kalam (meaning unknown), mahi kolme, kolme Gorgan, talaji or telagi (in Gilaki and Mazandarani, meaning unknown), latter three used for fish identified as *R. r. caspicus* natio *knipowitschi*), mahi cheshm qermez (= redeye fish), kolme Kura or kolme Anzali for fish identified as *R. r. caspicus* natio *kurensis*, kolme Gorgan or kolme Turkmenistan for fish identified as *R. r. caspicus* natio *knipowitschi*.

[Kulma, kyumen, Kur kulmasi and xazar kulmasi in Azerbaijan; kasli akcapagy in Turkmenian; vobla, Astrabadskaya vobla or Astrabad vobla, Astrakhanskaya vobla or Astrakhan vobla, Kurinskaya vobla or Kura vobla, severo-kaspiiskaya vobla or North Caspian vobla, Turkmenskaya vobla or Turkmenian vobla, Sibirskaya plotva or Siberian roach, soroga, chebak, and serushka for *R. r. fluviatilis*, all in Russian, roach being the English equivalent of vobla; river whitefish, whitefish (whitefish usually refers to salmonids not native to Iran)].

Systematics. *Cyprinus Rutilus* Linnaeus, 1758 was originally described from lakes in

Europe, the type being from Sweden and this was the name, as *Rutilus rutilus,* long used for the species in Iran. A discussion of the taxa present in Iran and their names is given under the genus above. Earlier studies centre around fish named as *R. rutilus*, *R. rutilus caspicus* and *R. caspicus* but these are all subsumed under *R. lacustris* here when referring to Iranian fish. *Cyprinus lacustris* Pallas, 1814 was originally described from Siberia, Russia and *Leuciscus rutilus* var. *caspicus* Yakovlev, 1870 was described from the Volga River delta and types are unknown for both (*Catalog of Fishes,* downloaded 11 September 2017).



Leuciscus rutilus var. *caspicus*, pharyngeal arch, after Yakovlev (1870) which does not illustrate a whole fish.

Bogutskaya and Naseka (2004) and Kottelat and Freyhof (2007) recognised *Rutilus caspicus* (Yakovlev, 1870) as the semi-anadromous species in the Caspian Sea with *R. rutilus* in rivers and lakes. The presence of a resident *R. rutilus* (or even a distinct taxon) and a semi-migratory *R. caspicus* (now referred to *R. lacustris* after Levin *et al*. (2017)) needs to be resolved for Iranian populations. Most Iranian populations are close to the Caspian Sea and are actually or potentially semi-migratory and so are treated here as that species. Data on them cannot be easily differentiated as the resident and the semi-migratory species, if indeed the former exists. Pourshabanan *et al*. (2021) using molecular techniques mentioned in a brief abstract that only two *Rutilus* species occurred in the Caspian Sea basin of Iran, presumably *R. kutum* and *R. lacustris*.

Studies below in the various sections for Iranian fish may reference *R. rutilus*, *R. r. caspicus* or *R. caspicus* as the use of *R. lacustris* for this taxon is recent, but this is not listed for each study. Often there is no clear separation or indication in these studies between resident and migratory populations.

Curiously, nominal *R. caspicus* and *R. frisii* showed low genetic divergence in a study by Ketmaier *et al*. (2008), a study using DNA but sample sizes were low.

Holčík and Skořepa (1971) revised the roach, *R. rutilus*, and found no reason to maintain subspecies, of which they listed 12. *Rutilus rutilus caspicus* (Yakovlev, 1870) (North Caspian or Astrakhan vobla) was the subspecies found in the Caspian Sea basin with natio *knipowitschi*

Pravdin, 1927 (Astrabad or Turkmenian vobla) in Gorgan (= Astrabad) and Gasan-kuli bays and the Gorgan, Atrak and Qareh Su rivers and natio *kurensis* Berg, 1932 (Kura vobla) in Kyzylagach Bay, the Kura River, Astara and rarely the Anzali Talab. The Kura vobla was said to differ from the Astrabad vobla by a greater body depth, smaller eye and more rapid growth. *R. r. caspicus* was distinguished from other subspecies by having modally 9 dorsal fin branched rays, darker fins, more inferior mouth, higher dorsal and anal fins, longer pectoral and pelvic fins, a deeper head, and larger eyes (see Berg (1948-1949) for more details). *R. r. caspicus* was originally described as *Leuciscus rutilus* var. *caspicus* from the Volga River delta, Russia. Eschmeyer *et al*. (1996) listed *Leuciscus rutilus* var. *wobla* Grimm, 1896 described from the North Caspian Sea and mouths of rivers (Volga, Ural, Emba, Terek, Kura, Astara) entering the Caspian Sea. This is presumably a synonym of *Rutilus rutilus* (as was) judging from the subspecific name which is the Russian word for this species (wobla = vobla or roach). Kottelat (1997) listed it as a nomen nudum.

Holčík and Skořepa (1971) recognized the Caspian Sea populations as the morph or morpha *migratorius*, perhaps a first step towards differentiation and speciation. Mironovskii and Kas'yanov (1986, 1987) however, retained *Rutilus rutilus caspicus* (= *R. lacustris*) as a distinct subspecies in the Caspian Sea based on a multivariate analysis of 12 meristic and seven morphometric characters. Mironovskii (1991, 1992) also demonstrated differences between Turkmen and Azerbaijan samples. Kuliyev (1984) considered these variations to be responses to different and changing conditions of the environment.

Naddafi *et al*. (2002) demonstrated differences in meristic (anal fin rays, predorsal scale number and total body vertebrae of 12 characters studied) and morphometric characters (7 measurements of 28 studied) for fish from the Anzali Wetland and the Gorgan River estuary of Iran. Patimar *et al*. (2005) found morphological differences between fish from the Gomishan Wetland and those from the Aj-gol and Alma-gol (= Ulmogol) wetlands in southeast Iran, and between the latter two wetlands. Inter- and intra-population variation was higher in the Gomishan fish. Keyvanshokooh and Kalbassi (2006, 2009) however, found the value of Nei's genetic distance (d = 0.04) to be small between these two populations using DNA. The populations had similar levels of polymorphism. Keyvanshokooh *et al*. (2007) compared populations in the Anzali Wetland and Gorgan Bay using microsatellite markers and found differences between both populations were not significantly different for average number of alleles per locus nor for observed heterozygosities. Parafkandeh Haghighi and Rezvani (2005) and Parafkandeh Haghighi (2006) used the trace element content in otoliths to demonstrate the presence of two different populations in the southern Caspian Sea, the Anzali-Kura and the Gorgan-Turkmen, as noted above on meristic and morphometric values. Rezvani *et al*. (2006) used mitochondrial DNA to compare Anzali and Turkmen roach and found the former to be more genetically variable, attributing this to there being more rivers, and therefore more spawning populations, in that area. Kashiri *et al*. (2010) found high diversity within populations of the Golestan coast using microsatellite loci. Kashiri *et al*. (2012) found low genetic differentiation between populations from the Gharesou (= Qareh Su) and Gomishan regions in Iran using microsatellite loci. Most variation is within populations but they could be separated. Kashiri *et al*. (2012) compared microsatellite loci from fish in the Anzali and Gomishan wetlands and found populations were probably separated. Reyhani *et al*. (2010) used microsatellite markers and found higher heterozygosity in Anzali Wetland fish compared to those from Gorgan Bay. However, gene flow was high and population differentiation was non-significant. Rezvani Gilkolaei (2011) used microsatellite markers for 90 fish from the Anzali Lagoon and Gorgan

Bay, and the Volga River of Azerbaijan. The average of expected and observed heterozygosity was 0.5 and 0.7, respectively. There were no significant differences between Iranian locations but there were between Iranian and Azerbaijan populations.

Ghojoghi *et al*. (2014a) found differences in morphometry between Aras River, Anzali Wetland fish and Bandar-e Torkeman populations and suggested they be considered as distinct stocks. Ghojoghi and Eagderi (2014) compared Turkmenian (Gomishan Wetland) and Kura (Talesh region) populations morphometrically and found the sexes and the populations to differ. The Kura population had a bigger head, longer anal fin and a deeper body, attributed to environmental factors. Ghojoghi (2015) found differences in the caudal skeleton of fish from the Aras River, Anzali Wetland and the Gomishan Wetland.

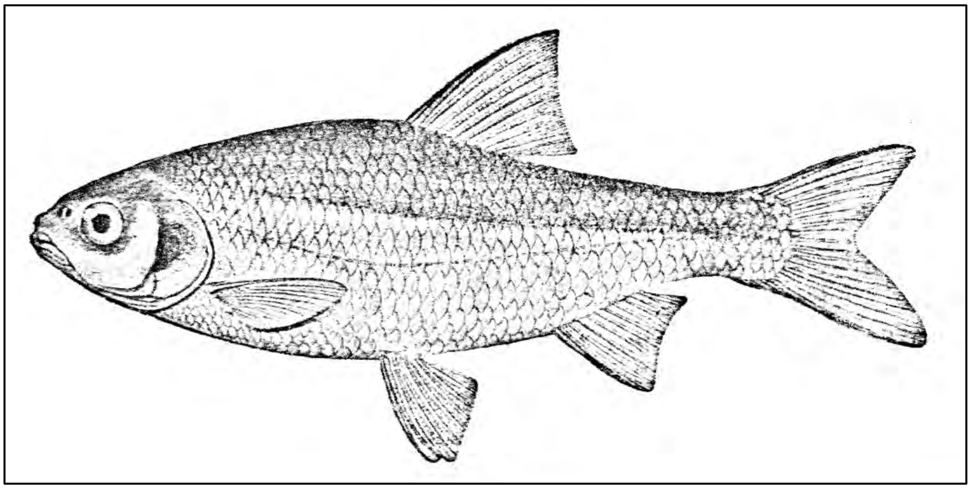
Sharifi *et al*. (2016) and Behmanesh *et al*. (2017) analysed cytochrome *b* and found that the population in the Aras Lake was genetically differentiated from south Caspian Sea populations (Astara and Bandar-e Torkeman) and these latter two areas represent a single panmictic population. Laloei *et al*. (2016) using microsatellite DNA found genetic divergence was significantly different between samples of Golestan and Gilan, Gilan and Mazandaran and Gilan with Gorgan Bay.

Jabeleh (2020) used microsatellite markers to compare wild broodstock, farmed and hybrids from three populations and found the genetic distances between the wild, farmed and mixed offspring populations were 0.459, 0.298 and 0.684, respectively. The results of molecular variance analysis revealed that genetic diversity within the individual was 90 percent, while among them it was three percent. The Fst value was 0.032 indicating the low genetic differentiation between the three populations which could be explained by the low number of alleles in the three populations. Furthermore, the natural migration (Nm) between two stations was 7.394. Cluster analysis based on genetic distance showed that the breeding and hybrid populations are in a separate branch from the wild population.

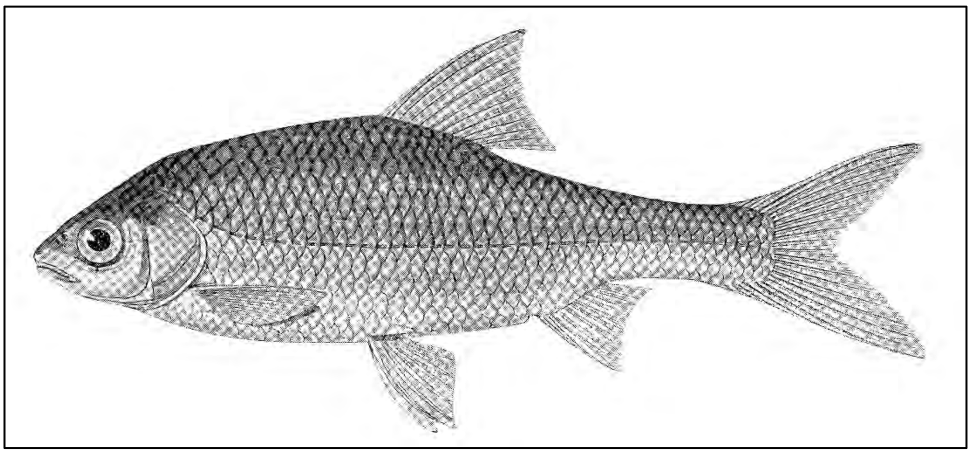
Hashemzadeh Segherloo *et al*. (2021) genotyped 7,984 single nucleotide polymorphisms and sequenced the mitochondrial C oxidase subunit I gene of 37 *R. lacustris* and *R. frisii* (= *R. kutum*) from the southeast and southwest Caspian Sea and the Aras River. The first two populations were closely related but highly differentiated from the Aras River population. Three hybrids were found with mtDNA from *Abramis brama* or *R. frisii* (= *R. kutum*) and nuclear DNA from *R. lacustris*.

Three "types" of *Rutilus rutilus caspicus* (= *R. lacustris*) have been reported from Iran (*Annual Report, 1995-1996, Iranian Fisheries Research and Training Organization, Tehran*, pp. 54-55, 1997). One type lived in the Anzali Talab and was relatively small, the second was larger and migrated between Anzali and the Kura River of Azerbaijan and the largest migrated between the northern and southern coasts of the Caspian Sea.

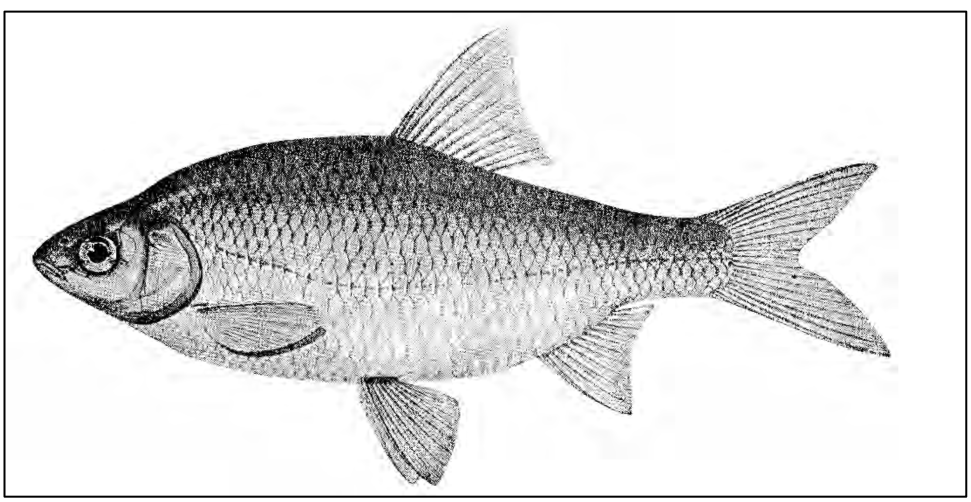
Rutilus rutilus schelkovnikovi Derzhavin, 1926 (syntypes many, whereabouts unknown, *Catalog of Fishes*, downloaded 11 June 2021) was described from the Karasu which falls into the Aras River 5 km above the mouth of the Zanga River (Razdan River), Echmiadzin District, Armenia. *Rutilus rutilus uzboicus* Berg, 1932 from lakes in the Uzboi River Valley (with the type from Lake Yaskhan) in Turkmenistan north of the Iranian border has seven possible syntypes under ZISP 2312. The former is included in *R. lacustris* by Levin *et al*. (2017) and the latter too is presumed to be a synonym (given as a synonym of *R. rutilus* in the *Catalog of Fishes*, downloaded 15 May 2018). *Leuciscus rutilus* var. *fluviatilis* Jakovlev, 1870 described from the delta of the Volga River was not addressed by Levin *et al*. (2017) and is given as a synonym of *R. rutilus* in the *Catalog of Fishes* (downloaded 15 May 2018).



Rutilus rutilus schelkovnikovi, syntype, after Derzhavin (1926).



Rutilus rutilus uzboicus, holotype, 18.4 cm total length,
Turkmenistan, Lake Yashkan along the Uzboi, after Berg (1932).



Leuciscus rutilus var. *fluviatilis* (= *R. r. fluviatilis*), 18.6 cm total length,
Russia, Volga River delta, after Berg (1932).

Hybrids with *Blicca bjoerkna* were reported from the Aras River basin in Armenia, which is shared with Iran. Artificial hybrids with *Rutilus frisii kutum* (= *R. kutum*) and *Abramis brama* have been bred in Iran (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization*, *Tehran*, pp. 39-40, 1996).

Key characters. This species is distinguished from the related *Rutilus kutum* by the lower scale count (< 50) and the posterior part of the gas bladder being rounded rather than pointed.

Morphology. The body is relatively deep and rounded and is somewhat compressed but can be quite thick. It is deepest at a level behind the end of the pectoral fin. A nuchal hump may develop. The predorsal profile is strongly convex. The caudal peduncle is compressed and moderately deep. The head tapers as part of the dorsal profile to a rounded snout. The eye lies well into the anterior half of the head. The mouth is gently oblique and is terminal to slightly subterminal. Lips are thick. The mouth extends back level with the anterior eye margin. There is a groove in front of the nostrils across the head. The dorsal fin is emarginate and the fin origin lies over or posterior to the pelvic fin origin level. The depressed dorsal reaches back almost to, or level with, the anal fin origin. The caudal fin is moderately to deeply forked with pointed to rounded tips. The anal fin is emarginate and does not extend back to the caudal fin base. The pelvic fin is rounded and does not extend back to the anal fin origin. The pectoral fin has a straight to rounded margin and does not extend back to the pelvic fin origin.

Dwarf and large forms are recognised in Dagestan by Shikhshabekov (1969) with different life histories, and distinct spawning stocks are known from the north Caspian Sea.

Dorsal fin unbranched rays 2-5, branched rays 8-12, usually 9 or 10 in the Caspian Sea, anal fin unbranched rays 2-4, branched rays 8-12, mostly 9-10, pectoral fin branched rays 14-18, and pelvic fin branched rays 7-9. Lateral line scales 39-48, mostly 42-47. There is a pelvic axillary scale and a scaled keel behind the pelvic fins. Scales have a squarish shape with a wavy anterior margin and a finely crenulated posterior margin. Dorsal and ventral margins are slightly rounded and the anterior corners are abrupt but rounded. Scales have very numerous fine circuli around a central focus. Radii may be found on all fields but fish often lack radii on lateral fields. Radii on anterior and posterior fields are widely spaced. Usually there are very few anterior and posterior radii (e.g., in a fish 150.7 mm standard length there are 2 anterior and 4 posterior radii; but counts are quite variable, at least 7-14 radii total). Total gill rakers number 9-17, usually 10-14, short and stubby and reaching the adjacent raker when appressed. Pharyngeal teeth are 6-5 or 5-5, rarely 6-6, 4-5, 5-4 or 5-6 with the grinding surface slightly folded to form a long, hollow crown for the largest teeth. There is a rounded and hooked tip to teeth 1-4. The tooth margin in the posteriormost two teeth is serrated. The anteriormost two teeth are rounded. Teeth are more serrated and hooked in smaller fish. The gut is s-shaped with a small anterior loop. Total vertebrae number 37-43. Lake populations generally have more vertebrae than river populations and the number of vertebrae is genetically fixed, generally following the maternal genotype (Izyumov and Kas'yanov, 1995). The chromosome number for *R. rutilus caspicus* (= *R. lacustris*) is 2n = 50 (Klinkhardt *et al*., 1995; Arai, 2011).

Ghojoghi *et al*. (2014b) described the osteology of this species from Turkmen Harbour specimens and Hasanpour *et al*. (2015, 2016) described the developmental osteology of the vertebral column and the paired, dorsal and anal fins of fish from Sijval Restocking Center, Bandar-e Torkeman. Zakeri Nasab *et al*. (2018) described the morphology and histology of the gut and accessory glands. Mazaheri Kouhanestani *et al*. (2020) gave a description of the larval stage from southeastern waters of the Caspian Sea. Eagderi *et al*. (2021) outlined the

development of the eye during early ontogeny.

Meristic values for Iranian specimens are:- dorsal fin branched rays 9(22) or 10(18), anal fin branched rays 9(16), 10(23) or 11(1), pectoral fin branched rays 14(1), 15(4), 16(22), 17(12) or 18(1), pelvic fin branched rays 7(4), 8(33) or 9(3), lateral line scales 40(1), 41(4), 42(16), 43(11), 44(5) or 45(3), total gill rakers 11(4), 12(15), 13(18) or 14(3), pharyngeal teeth 6-5(22), 6-6(1), 6-4(1) or 5-5(1), and total vertebrae 37(1), 38(-), 39(2), 40(9), 41(64) or 42(19).

Sexual dimorphism. Tuberculation of mature fish is figured above in a line drawing. In four males caught on 26 April 1962 (150.7-170.3 mm standard length, CMNFI 1980-0905), moderate-sized tubercles were evenly distributed over the top and sides of the head, with fewer tubercles on the undersurface. Scales bore one strong tubercle in the exposed mid-scale, anterior and dorsal scales had smaller tubercles on the scale margin and belly scales had minute tubercles on the margin and exposed scale base. Fine tubercles followed the branching fin rays in single file on all fins, both dorsally and ventrally on the pectoral and pelvic fins, and in 1-2 rows on the last unbranched ray of each fin. Some fish had some scales with 1-3 tubercles, usually 2, one above the other. When there were three tubercles these were variably arranged, e.g., in an L-shape or a reversed L. Females also bore tubercles on the head and scales but these were less well-developed and were not present on fins.

Ghojoghi *et al*. (2014a) found dimorphism in morphometry within Aras River and Anzali Wetland fish, but not Bandar-e Torkeman fish, with females having a deeper body and lower anterior position of the snout and, for Aras fish, a smaller female head.

Colour. Overall colour is silvery. The back is grey and the sides of the head golden. The belly is pearly-white. The iris is silvery with a black spot above the pupil, some gold on the upper part, and may be orange to red. Pectoral, pelvic and anal fins are light grey with a darker band on the edge. The middle of the pelvic and anal fins may be transparent, orange to pink, or red. The peritoneum is silvery with moderately dispersed but evident melanophores.

Size. Attains 56.0 cm and 3.13 kg. Larger fish may be hybrids with *Rutilus kutum*. In Iran during the 1950s, catches were 16-35 cm long (Farid-Pak, No date).

Distribution. Found from drainages of the Aegean Sea and Atlantic Ocean to the Black-Azov, Caspian and Aral seas, inland waters of Central Asia, and the Arctic Ocean as *R. lacustris*. For the taxon *R. rutilus*, should it be present in Iran, the distribution is from the British Isles and France eastwards to the Volga River basin and the Caspian and White Sea drainages, north of the Alps.

Abdoli (2000) and Abdoli and Naderi (2009) have natio *knipowitschi* (see above for taxonomy) in Gorgan Bay and the neighbouring Caspian coast and in the Atrak, Gorgan and Qareh Su rivers, and natio *kurensis* in the lower Sefid River, Anzali Talab and neighbouring Caspian coast to Astara and the middle Aras River.

This species is found in the Aras, Astara, Atrak, Babol, Behambar, Fereydun Kenar, Ghorichay, Ghotor, Goharbaran, Golshan, Gorgan, Haraz, Langarud, Larim, Nahang, Pir Bazar, Qareh Su, Rasteh, Sefid, Shafa, Shah, Shalman, Shesh Deh, Siah, Siah Darvishan, Tajan, Talar and Zangbar rivers, Ajigol, Alma-gol (= Ulmogol), Amirkelayeh, Boojagh Kiashahr, Gomishan and Miankaleh wetlands, the Anzali Talab and its mouth and tributaries, the Siahkeshim Protected Region, the Astara Talab, Gorgan Bay, Lake Amirkelayeh, the Alborz and Aras dams, and along the whole Caspian Sea coast (Nedoshivin and Iljin, 1929; Berg, 1948-1949; Kozhin, 1957; *Iranian Fisheries Research and Training Organization Newsletter*, 9:5, 1995; Riazi, 1996; Karimpour, 1998; Abbasi *et al*., 1999, 2017; Kiabi *et al*., 1999; Youssefi *et al*., 2005; Khara *et al*., 2006a, 2008; Masoumian, 2007; Banagar *et al*., 2008; Piri *et al*., 2009; Tatina *et al*., 2009;

Alipour *et al*., 2015; Levin *et al*., 2017; Nouroozikoh *et al*., 2017). Rasouli *et al*. (2011) reported it from Marmisho Lake, west of Urmia.

Tavakol *et al*. (2015) recorded *Rutilus rutilus* (*sic*) in the Mahabad Dam of the Lake Urmia basin which could be a misidentification or an introduction.

Rutilus rutilus aralensis Berg, 1916 (Levin *et al*. (2017) placed this taxon in their *R. lacustris*) is reported from the Karakum Canal and Kopetdag Reservoir in Turkmenistan (Shakirov and Sukhanova, 1994; Sal'nikov, 1995) and may eventually be found in the Tedzhen (= Hari) River basin of Iran.

Zoogeography. This species is a member of the Ponto-Caspian clade as defined by Levin *et al*. (2017) with a wide European and Asian distribution. Their molecular data indicated an intricate phylogeographic history with multiple refugia within the Ponto-Caspian region.

Habitat. Berg (1948-1949) gave an extensive account of the biology of this species in the North Caspian Sea and Volga River and there have been numerous studies since not reviewed here. This is a eurytopic species, living in rivers, streams, lakes, dams, lagoons, ponds, marshes and fresher parts of seas. It occurs in schools close to vegetation in fresh waters.

It gathered in front of the Volga River delta in the north of the Caspian Sea in large shoals in autumn when water levels decreased. At water temperatures of 5°C they descended to the sea floor and "lie in winter sleep" (Holčík and Skořepa, 1971). It is not known if this occurs off the warmer Iranian shore. Generally, the vobla lives in the sea itself and migrates to rivers for spawning. Although most spawning took place in fresh water, some occurred at a salinity of 6.5‰. This species was the most tolerant of the semi-anadromous fishes, the lethal salinity level being 15-16‰. In the north Caspian Sea, this fish was found mostly shallower than 7.5 m but Knipovich (1921) reported this species at 36.6-53.0 m in the Iranian Caspian Sea.

A mass migration of the Kura vobla (natio *kurensis*) into the Anzali Talab occurred between 21 and 28 February 1915, only to disappear after 4 April. Riazi (1996) reported that this species migrated into the Siahkeshim Protected Region of the Anzali Talab. Males migrated into the Anzali and Gomishan wetlands of Iran earlier than females and the larger fish entered first (Naddafi *et al*., 2005).

Natio *knipowitschi* lives in the sea in Gorgan and Gasan-kuli bays and enters rivers there. Savenkova (1985) reported as many as 2,000 million juveniles descending the Atrak River in May and June in high productivity years and as few as 83 million in low productivity years. The sea in July and August was as warm as 28-30°C off the Iran-Turkmenistan border and the juvenile fish from the Atrak descended to 11-12 m. They fed in the sea at depths of 4.0-8.5 m and wintered in Iranian waters (Savenkova, 1985). Savenkova (1994) gave further details of movements in relation to temperature, e.g., when waters cooled to 8-12°C off Turkmenistan, young fish moved to warmer Iranian waters to overwinter. It has been caught at 32°C in the Sefid River estuary in marine water on 9 July 1962 (CMNFI 1970-0565). ERM-Lahmeyer International GmbH, DHI Water & Environment and GOPA Consultants (2001a) reported that the Gomishan Lagoon at 37º11'N, 53º57'E is an important staging area for this species.

Habitat of *Rutilus lacustris*, CMNFI 1979-0477, Golestan, Bandar-e Torkeman,
5 July 1978, Brian W. Coad.

Age and growth. Generally, growth is a function of type of feeding (a diet favouring molluscs gave higher growth than herbivory) and temperature. High growth rate was shown by semi-migratory fish but was also shared by some populations resident in lakes and rivers. Kas'yanov *et al*. (1995) reviewed the complex relationships of environmental factors affecting growth in this species.

A life span up to 19 years has been reported although most fish were 10 years or less. Growth was fastest in the second and third years of life when most fish matured sexually (Strubalina and Chernyavskiy, 1992).

Some fish matured at 1 year of age and a length of 9-11 cm in the Atrak River population (Petr, 1987). Growth in the Atrak population juveniles was heavily dependent on temperature regimes in the sea, the timing of descent to it, and stock abundance. Fish which descended earlier because of low flow and had a longer feeding season, found a favourable, warm regime and few competitors would have faster growth (Savenkova, 1994).

Young-of-the-year Turkmen fish reached 4.9-5.8 cm in July while in the northern Caspian they only attained 3.3-4.1 cm, although the latter had a higher condition factor, possibly because of higher benthic biomass and heterogeneity (Savenkova, 1994). The dwarf form in Dagestan was 11 cm and 31 g at 3 years of age while the large form was 20.3 cm and 130 g. Both were sexually mature (Shikhshabekov, 1969).

The commercial catch in Iran during 1971/72 was 3-6 years old, 20.4-26.0 cm long and weighed 146-300 g (Razivi *et al*., 1972). The average weight in 1995 was 200-300 g (*Abzeeyan*, Tehran, 5(9):V, 1995).

In Gorgan Bay, the age composition was from 1^+ to 6^+ with age group 3^+ and 4^+ each accounting for about 30% (Berg, 1948-1949). Growth rate for all south Caspian populations was higher than the north Caspian populations, two-year-olds being the same length as three-year-

olds. Average weight was 247 g with larger fish at 30 cm weighing 583 g. Numerous fish entered Gorgan Bay in mid-January in the early years of this century and by the end of that month ascended all the tributary rivers, in particular the Qareh Su (= Karasu).

Growth rate in the Anzali Talab was higher than in the Gomishan Wetland of the southeastern Caspian Sea, limited by higher salinity in the latter (Naddafi *et al*., 2002a, 2002b, 2005; Paghe *et al*., 2005). The population density was higher in Gomishan as Anzali suffers more from pollution, overfishing, illegal fishing and other human impacts. Mean condition factors for the Gomishan population were 1.84 for males and 2.09 for females while in the Anzali population these were 2.03 and 2.2 respectively. The most abundant age groups in the commercial fishery of both areas were 3^+, 4^+ and 5^+. Maximum age at Gomishan was 8^+ years. Growth was rapid in the first year with a sharp decline in the second year and a steady, less rapid decline in subsequent years. Females were longer than males at in each age class. Sex ratios did not differ significantly from 1:1. The Anzali population had longer body lengths than fish from other studies, perhaps due to a longer growing season and higher water temperatures in the south Caspian Sea, better food supply and genetic factors.

Sedaghat and Hoseini (2012a) found southern Caspian Sea fish to have an age to 6 years with two-year-olds most frequent. The length-weight relationship showed positive allometric growth and was $W = 0.0065FL^{3.30}$. Abbasi *et al*. (2017) examined 232 fish from Gilan coasts in 2011-2013 and found fork lengths 105-230 (mean 159.5) mm, body weight 17.2-201.2 (mean 65.0) g and age 1-4 years, condition factor was 1.11, growth was positive allometric, and females constituted 60.3% of all fish. Overfishing was noted as a problem requiring stock management.

Mohammad Nejad Shamoushaki *et al*. (2013) analysed the catch from 1999 to 2008 in Golestan Province from 20 active seine cooperatives. The catch in the west (Miankaleh) was not significantly different from that in the east (Gomishan). Catches declined over the period studied and the catch ratio was carp>mullet>kutum>roach at 39.23, 33.76, 26.54 and 0.47%.

Bandani (2016) examined samples caught in beach seines in Iranian waters. The fork length and total weight ranged from 12.5 to 29.5 cm and 29.0 to 293 g and 10.5 to 23 cm and 17.2 to 21.0 g in Golestan and Gilan Provinces, respectively. The *b* value of the length-weight relationship ranged 3.02 to 3.25 and 3.28 to 3.75 for females and males, in Golestan and Gilan Provinces, respectively. The age composition of the catch was from 1 to 4 years in both provinces. Average growth in length was described with the von Bertalanffy growth model, L(t) = 30.94(1-exp (0.42(t-0.18) and L(t) = 20.49(1-exp (0.53(t-1), respectively by province. Bandani (2016) examined samples taken from beach seine catches and at fish markets. The age composition was 1 to 4 years and most of the catch was in the length range of 18 to 20 cm. Growth parameters were $L_\infty = 32.39$ cm and K = 1.24/year, total mortality, natural mortality rate, fishing mortality and growth performance index were 1.09/year, 0.26/year, 0.4 and 2.54, respectively. The biomass and maximum sustainable yield were estimated at 368.9 t and 32.7 t. Bandani *et al*. (2018) gave growth and mortality parameters for the southern Caspian Sea but there is confusion in values between Farsi and English abstracts.

Taghavi Jolodar and Amiri Sahebi (2016) examined 160 fish from Sari and Torkeman ports and reported the mean age, body weight and fork length for Sari and Torkeman were 2.8 and 2.4 years, 117.67 and 76.73 g, and 18.56 and 16.5 cm. There was a significant correlation between age, weight and length. The male:female sex ratio was 1:1.5 in Sari and 1.7:1 in Torkeman fish, significantly different. Mean condition factors were 1.24 in Sari and 1.12 in Torkeman fish.

Dordi Tatr *et al*. (2018) and Tatar *et al*. (2018) examined 246 fish from cooperative beach

seines in the southeastern Caspian Sea and found fork lengths 14.5-32.1 cm, weights 70.7-437.0 g, an age range of 3-10 years, the von Bertalanffy equation was $L_t = 41.8[1\text{-}e\text{-}0.12(t+0.766)]$, the length-weight relationship was isometric, $W = 0.0208FL^{2.9184}$ for females and $W = 0.0138FL^{3.0244}$ for males, total mortality (Z), natural and fishing coefficients (M, F) and exploitation rate (E) were 1.239, 0.324, 0.916/year and 0.74 respectively, fish biomass was 417 kg, maximum sustainable yield was 215 kg and the ration of cooperative companies was 28 kg. The stocks were severely exposed to overfishing and conservation is needed.

Rahnama *et al*. (2019) studied 384 specimens from coastal waters of Golestan Province caught by gillnet and beach seine from April 2015 to March 2016. The smallest and largest fish were at 14 and 26 cm and the minimum and maximum weights were 28 and 246 g. The *b* value for males and females was 3.012 and 3.205 respectively. W_∞ was estimated about 216.466 g in males and 259.77 g in females. The natural and fishing mortality rates in both males and females were 1.13, 0.401 and 0.84, 0.673 per year. The utilization factor was Φ' = 0.26 and 0.43 in males and females. The growth performance index was estimated at 2.57 for males and 2.48 for females. The age groups were from one to four years old, the most frequent being one to two plus years old.

Kor *et al*. (2020) reported on broodstocks collected from the Gorgan River estuary over five years from 2014 to 2018 during February-March for semi-natural propagation. Total length and weight of the broodstocks ranged from 21.0 to 32.5 cm and from 45.6 to 423.5 g, respectively. The largest mean value of lengths and weights were observed in 2014, and the smallest in 2018. The age of broodstocks ranged between 3^+ and 9^+ years. The abundance of ages and sexes differed between years. Females had positive allometry in all years, while males ranged from 2.65 to 3.05, indicating mainly negative allometric growth. Different instantaneous growth rates were observed over the five years, indicating the presence of strong and/or weak ages and/or cohorts in the populations. The condition factors of females were larger than that of males in all periods. The results showed that L_∞ of males ranged from 26.49 to 38.53 cm, and that of females from 32.45 to 41.97 cm, the K-coefficient ranged between 0.12 and 0.24/year for males and between 0.11 to 0.21/year for females, and t_0 of males ranged from -0.21 to -0.34 (year), and that of females from -0.39 to -0.99 (year).

Jableh *et al*. (2016) compared 587 wild, farmed and mixed populations of fingerlings from a fish farm and found *b* values of 2.58, 2.505 and 2.45 respectively and condition factors of 0.9, 0.832 and 0.842 respectively. Growth parameters of wild fish were better than farmed and mixed populations.

Food. The young feed first on phytoplankton and then switch to zooplankton and benthic insect larvae with growth. Adults eat benthic animals and plants with molluscs an important diet item where present as in the southern Caspian Sea. A mollusc diet occasioned significant wear on the pharyngeal teeth (Holčík and Skořepa, 1971). Moharamifard *et al*. (2015) found nereids and gammarids were important diet items on the Mazandaran coast. There has been a long-term variation in the diet of roach in the Caspian Sea, molluscs declining and being replaced by crustaceans and plants (Strubalina and Chernyavskiy, 1992). There was little feeding during spawning in rivers. Young-of-the-year in the Atrak delta fed on the polychaete worm *Nereis* (up to 89.5%) and with growth the mollusc *Cerastoderma lamarckii* (up to 70.8%), and to a lesser extent the exotic mollusc *Abra ovata* (5.2%) since this abundant species was partially buried and was not readily available. Polychaetes and molluscs had high biomasses in the silty sediments of around 30-50 g/sq m. Sometimes protozoans and crustaceans figured prominently in the summer diet but diet varied considerably between months and years (Savenkova, 1994). Abbasi *et al*.

(2017) examined 232 fish from Gilan coasts and calculated a coefficient of vacuity of 30.6%, a relative length of gut 0.96 and an intensity of fullness 199.0. There were more than 15 food items with polychaete worms and mollusks dominant. Bandani (2016) for Golestan and Gilan fish found that gastropods, polychaetes, worms and molluscs dominated. Shrimps, fishes, insects, zooplankton and clams were scarce prey.

Reproduction. A spawning migration runs up rivers in the Caspian Sea basin in spring, the larger fish first. The main spawning rivers in Iran are the Qareh Su, Goharbaran, Larim, Siah-Darvishan and Shafa rivers (*Iranian Fisheries Research and Training Organization Newsletter*, 9:5, 1995). Spawning grounds are mostly flooded meadows that warm up easily (Caspian Sea Biodiversity Database, www.caspianenvironment.org). Immature fish only migrated in autumn after their gonads had matured, spending the summer in deeper water. The fish return to the sea after spawning in the same sequence as the upriver migration. Young remain in the river until early summer when they too go down to the sea. However, some populations of this species were exclusively freshwater and did not migrate.

Spawning is continuous and takes about 5-6 hours. Fecundity reaches about 202,000 eggs and egg diameters 1.6 mm. In the Volga delta, this species spawned in the same areas as *Abramis brama*. However, it spawned earlier at temperatures of 7-16°C on last year's dead vegetation while the bream spawned later at 15-23°C on new growth. Spawning can occur on stony bottoms in the absence of vegetation. Spawning is a noisy process which can be heard from some distance. Each female is accompanied by 2-3 males who push on her belly, sometimes lifting her part way out of the water, as they swim in circles. With many fish engaged in this process, the water foams. The fish gradually approach the shore where the eggs are shed in water only 5-20 cm deep as the female is squeezed by two males. Other males take part in the process, as many as 10 at a time. Incubation takes four days at 17-20°C. Young actively move downstream once they reach 20-25 mm.

The breeding migration in the Atrak River started in January-February and continued until April, the fish traveling 70-80 km upriver (Petr, 1987). Nümann (1969) stated that the spawning migration took place from November to December in Iranian waters. The migration in the Atrak peaked at 10-12°C and lasted 20-25 days. Spawning peaked at 15-18°C in March on the lower Atrak floodplains (in 1908 spawning in the lower Atrak was observed in mid-April). In the absence of flooding, no spawning occurred. After spawning, females migrated back to the sea first. In the Qareh Su of Gorgan Bay, spawning took place 20-25 km upriver from the mouth in 1907 and 1908. It started in mid-February, peaked in the second half of February and the first half of March, and ended between 20 and 30 March. Males with running milt first appeared between 14 and 20 February in 1915 and ripe females a week later. Mass spawning took place at the beginning of March (Nedoshivin and Iljin, 1929).

Adeli Mosabbab and Piri (2005) reported spawning in Iranian rivers from the end of March to the middle of April, beginning at 10°C. A large female, 60 cm long, 3.24 kg and 7 years old contained 124,712 eggs but some large females may have over 250,000 eggs.

Fecundity in the Gomishan Wetland (4,262-98,804 eggs) was significantly higher than in the Anzali Talab (6,035-32,141) for a given body size. Egg diameters ranged from 0.9 to 1.45 mm and were not significantly different between the two wetlands. The peaks for the gonadosomatic index (GSI) curves were early March for males and mid-March to early April for females. The GSI was higher in Gomishan (Naddafi *et al.*, 2005). Akhoundian *et al.* (2016) gave details of ovarian development of fish from the Qareh Su River near Bandar-e Torkeman and also found a spawning period from late March or early April till the end of April based on

gonadosomatic indices. This species was found to be an iteroparous synchronous spawner. Bandani (2016) for Golestan and Gilan fish noted there was one spawning peak and fecundity variations were high and ranged from 7,260 to 231,965 eggs.

Başkurt *et al*. (2015) compared a Turkish population of *R. rutilus* with *R. rutilus caspicus* (*sic*) (= *R. lacustris*) noting the slow growth rates in the Anzali and Gomishan wetlands and fast growth in the Caspian Sea, ruling out taxon-specific differences in growth rates. However, these may well be different taxa in Iran.

Abbasi *et al*. (2017) examined 232 fish from Gilan coasts and found length at maturity in 50% of males and females was 151 and 155 mm fork length respectively, and spawning took place in March and April. Akhoundian and Movahedinia (2017) studied histomorphometric indices in oocytes and found seven stages of gonadal development, the first phase starting in October and vitellogenesis and maturation of oocytes continuing from February to April. This species has group synchronous gonads and spawning occurs after a reproductive migration to the southeast rivers of the Caspian Sea.

Parasites and predators. Mokhayer (1976b) recorded the cestode larva *Diagramma*. Jalali and Molnár (1990a) reported the monogenean *Dactylogyrus turaliensis* from this species in the Sefid River. Masoumian *et al*. (2002) recorded parasites from fish captured from the coast of the southeast Caspian Sea as *Anisakis* larvae, *Aspidogaster limacoides*, *Bothriocephalus gowkongensis*, *Dactylogyrus turaliensis* and *Diplostomum spathaceum*. Youssefi *et al*. (2005) found the plerocercoid larvae of *Ligula intestinalis* in fish from the Aras Dam. A toxin produced by this parasite could cause infertility and weight loss in the fish and could be harmful to humans. Khara *et al*. (2006a) recorded the eye fluke *Diplostomum spathaceum* for this fish in the Amirkelayeh Wetland in Gilan, having the highest infection rate in seven species examined and . Masoumian (2007) reported the parasite *Diplozoon megan* from fish in the Aras, Ghotor and Zangbar rivers in West Azarbayjan. Barzegar et al. (2008) recorded the digenean eye parasite *Diplostomum spathaceum*. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Lernaea* sp. on this species.

Khara *et al*. (2006b) recorded the cestode *Caryophyllaeus fimbriceps* from fish in the Boojagh Wetland of the Gilan coast and Khara *et al*. (2008) found the eye parasite *Diplostomum spathaceum* in fish from Boojagh. Tatina *et al*. (2009) found fish from the Boojagh Wetland contained *Caryophyllaeus fimbriceps*, *Diplostomum spathaceum*, *Piscicola* sp. and *Lernaea* sp. Khara *et al*. (2011) also listed the digenean *Diplostomum spathaceum*, the cestode *Caryophyllaeus fimbriceps* (but see Barčák *et al*. (2017) who indicated this needs confirmation), the crustacean *Lernaea cyprinacea* and the leech *Piscicola* sp. Boojagh fish.

Rasouli *et al*. (2011) found the crustacean *Argulus foliaceus* on fish from Marmisho Lake west of Urmia. Rasouli (2013) reported the digenean *Diplostomum spathaceum* in fish from Caspian drainages in West Azarbayjan. This parasite causes secondary infections as the metacercariae penetrate the skin and eye, lesions, appetite loss, blurry vision and reduced feeding. Tavakol *et al*. (2015) reviewed the acanthocephalan fauna of Iran and noted *Pallisentis cholodkowskyi* from *Rutilus rutilus* (possibly *R. lacustris*) in Mahabad Dam (*sic*). Nouroozikoh *et al*. (2017, 2017) surveyed infestation of fish with *Eustrongylides excisus* and *Ligula intestinalis* in Alborz Dam in Mazandaran, finding a high prevalence for these economically important parasites.

The main predator of this species in the north Caspian Sea is *Sander lucioperca* (pike-perch), accounting for 65% of its food. *Silurus glanis* (European catfish) and *Esox lucius* (northern pike) and various birds such as the pelican are also important predators (Kushnarenko,

1978). Khaleghizadeh and Sehhatisabet (2006) noted that great grebes (*Podiceps cristatus*) and pygmy cormorant (*Phalacrocorax* (= *Microcarbo*) *pygmaeus*) ate this species in Gilan. The Caspian seal, *Pusa caspica*, was a significant predator on this species (Krylov, 1984). On the spawning grounds, this fish could be picked up by hand and fell easy prey to birds and other predators. Ashoori *et al*. (2017a) recorded this species as an occasional item in the diet of young black-crowned night herons (*Nycticorax nycticorax*) in the Anzali Wetland.

Economic importance. This species is one of the most important commercial species in the Caspian Sea with a catch in the north Caspian and lower reaches of rivers in 1930 being 2,591,000 centners (15,000,000,000 fish) or 45.5% of the total catch of fishes in the Caspian Sea or nearly 20% of the whole Soviet fish catch. Archaeological studies on the eastern Caspian shore in the former Soviet Union have shown this species to have been fished for 5,000 years ago (Tsepkin, 1986). It is a significant food for the sturgeon *Huso huso* (Keyvanshokooh and Kalbassi, 2006).

The main fishing season in Iran is February and March (Farid-Pak, No date). Nevraev (1929) gave catches for various fishing regions in Iran in the early twentieth century. For the Anzali region from 1914-1915 to 1917-1918 the catch was 6,000 to 244,800 individuals (the catch declining steadily over this period), and in the Astrabad (= Gorgan) region from 1909-1910 to 1912-1913 the catch was 8,348,800 to 21,790,000 individuals. The catch in Iran from 1956/1957 to 1961/1962 varied from 2,989 kg to 1,092,719 kg (Vladykov, 1964), from 1965/66 to 1968/69 it varied from 32 to 74 tonnes (36, 74, 32 and 35 t respectively) (Andersskog, 1970) and from 1963 to 1967 from 2.4 to 47.0 t (23.1, 2.4, 3.7, 30.7, 47.0 t respectively) (RaLonde and Walczak, 1970b). Vladykov (1964) reported catches from the Anzali region for the period 1933/1934 to 1961/1962 to vary from 57 to 716,974 kg, with none reported in some years. Holčík and Oláh (1992) reported an annual catch in the Anzali Talab from 1932-1964 of 0.8-449.7 t. The total catch in 1989 (or 1990) was only 26 t but increased to 120 t in 1995 because of the rising Caspian Sea level which provided more spawning grounds (*Abzeeyan*, Tehran, 5(9):V, 1995; *Iranian Fisheries Research and Training Organization Newsletter*, 9:5, 1995). Conflicting values from reports where they overlap are typical of fisheries statistics from Iran which can only be taken as general trends rather than absolute values. The Food and Agriculture Organization, Rome gave the catch for *Rutilus* spp., presumably this species, for the years 1980-1985 as 0, 0, 0, 121, 347, and 350 t respectively. The catch in Gorgan Bay 20-30 years ago according to Petr (1987) was about 4,000 tonnes per year but was negligible at the time of this report. In the 1914-1915 fishing season in Gorgan (= Astrabad) Bay, 24.2 million fish were taken, of which 21.9 million were taken in the Qareh Su. Petr (1987) cited catches of 830 t in 1978 for the southeastern Caspian Sea and for 1979 only 120 t, probably including Soviet catches. Recruitment fell when the Atrak River, a major spawning ground, failed to flood adequately.

The dwarf form in Dagestan was of no commercial value and may have arisen with changing environmental conditions (Shikhshabekov, 1969).

Adeli and Namdar (2015) suggested the eggs of this species (as *Leuciscus rutilus*) as a substitute for sturgeon caviar.

Experimental studies. There have been relatively few experimental studies on this species in Iran compared to its congener. These are summarised by headings although not all study areas have been covered in publications. The species name used in most of these papers (*q.v.*) is *Rutilus rutilus*, *Rutilus rutilus caspicus*, *Rutilus caspicus* or even *Rutilus rutilus caspicus knipowitschi*, all assumed here to be *R. lacustris* (as noted in **Systematics** above).

Pollution:-

Anan *et al*. (2005) measured concentrations of 13 trace elements (Ag, Cd, Cr, Co, Cu, Hg, Mn, Mo, Pb , Se, Tl, V and Zn) in muscle of bony fishes collected from coastal areas of the Caspian Sea (Kazakhstan, Azerbaijan, Turkmenistan and Iran). Caspian roach were collected from five stations in Iranian coastal waters and the concentrations of Ag, Cd, Co, Mo and Tl were higher in fishes from western stations than those from eastern stations, whereas the opposite trend was observed for Hg, indicating that local sources of trace metal pollution may be present in the Iranian coastal areas of the Caspian Sea. Gerve'ei *et al*. (2008) determined that aluminium sulphate had an LC_{50} 96h of 0.725 mg/l and caused gill tissue lesions. Mohammadnezhad Shamoushaki *et al*. (2009) showed the LC_{50} 96 h for the insecticide endosulfan was 0.00053 mg/l, above the maximum allowable concentration at 0.000053 mg/l.

Abasi and Mohammadzadeh Baran (2010) exposed 5.0 cm long fish to mercury chloride at graded sublethal concentrations (10, 30, 50 μg Hg/l) and observed histopathological changes, such as telangiectasis (capillary dilation) and degeneration, in the ovary. Keramati *et al*. (2010) studied the effect of the agricultural organophosphate diazinon on enzyme activity. Mohammad Nejad Shamoushaki *et al*. (2010) found the lethal concentration (LC_{50} 96 h) of the herbicide roundup (glyphosate) used in agriculture was 7,728 mg/l. Mohammadzadeh *et al*. (2011) examined the effects of lead on liver and gill tissues finding various damage which increased with dosage. Sheikh *et al*. (2011) found an LC_{50} 96 h of 7.88 mg/l for diazinon which was classified as a toxic pesticide for this species of fish. Deformities, irregular behaviour and changes in haematocrit were observed. Gharedaashi *et al*. (2012) showed that copper was more toxic to fingerlings than lead. Hoseini and Nodeh (2012) found levels of copper and mercury in fry were less than in Caspian Sea water. Khosravi Katuli *et al*. (2012, 2012) examined the negative effects of the pesticide diazinon on gill histology and osmoregulation. Gill tissues were damaged and osmoregulatory capacity was reduced in both river and sea environments, and this may adversely affect later migratory capacity. Alipour *et al*. (2013) measured heavy metals (cadmium, chromium, lead, nickel) in pelagic fish from the Miankaleh Wetland finding levels lower than in the benthic goby *Neogobius gorlap* and liver and gill tissue had higher levels than muscle. Sharifian *et al*. (2013) found sublethal concentrations of nanosilver caused gill tissue damage to fingerlings and this damage could be used as an indicator of environmental contamination. Farokhi (2014) examined the deleterious effects of the insecticide malathion on haematological and biochemical parameters and on DNA. The LC_{50} value was 6.5 p.p.m. Farokhi *et al*. (2014) studied the effect of increased and prolonged exposure to the insecticide malathion and found a reduction in such haematological parameters as red and white blood cell counts and haematocrit and haemoglobin levels. Hedayati *et al*. (2014) found the LC_{50} 96 h for manganese was 300 mg/l and all concentrations (60-300 mg/l) showed decreased plasma alternative complement and lysozyme activity, significant increases were found in whole body superoxide dismutase, catalase and malondialdehyde, and there was a lower tolerance to saltwater. Mohamadzadeh and Gamili (2014) found lead affected gill and liver tissues of fingerlings, at 0.1 mg/l minimum tissue damage was observed, but with increasing time in 0.2 and 0.4 mg/l maximum tissue injuries were found. Soltani *et al*. (2014) demonstrated that concentrations of heavy metals (cadmium, copper, lead) in edible tissue of fish from Babol Sar and Tonekabon were safe for consumers.

Mazandarani *et al*. (2015, 2016) examined susceptibility to sublethal exposure to ammonia, which accumulates in earthen ponds used in aquaculture, finding 0.2 mg/l did not lead to mortality but was harmful for growth and haematological indices, and 0.162 mg/l was the maximum sublethal concentration for fingerlings. Raeisi *et al*. (2015) determined that cadmium

and lead heavy metals were highly toxic in muscle with lead showing higher toxicity in terms of nutritional parameters and antioxidant enzyme activity. Alipour *et al*. (2016) determined the levels of arsenic, copper, iron and zinc in fish from the Miankaleh Wetland, where liver levels were higher than in gill and muscle tissues, iron was higher than other metals, and arsenic levels were above the permissible limit for human consumption. Farokhi *et al*. (2016, 2016) found a wide range of liver and gill tissue damage and effects on enzymes in fish exposed to the insecticide malathion, the damage increasing with time and higher concentrations. The LC_{50} was 6.5 p.p.m. Hedayati (2016) found cadmium was toxic to this species with an LC_{50} of 5.26 p.p.m., lower than in silver carp, *Hypophthalmichthys molitrix*, at 6.58 p.p.m. Hedayati *et al*. (2016) showed that increasing sub-lethal levels of the insecticide diazinon caused increasing gill tissue lesions and Hedayati *et al*. (2016) measured the LC_{50} 96 h of diazinon at 1.71 mg/l, less resistant than silver carp at 3.93 mg/l. Hedayati *et al*. (2016) found that lead had negative effects on blood biochemistry, immune factors and such biochemical factors as glucose and cortisol, and could result in death. Khosravi Katuli (2016) noted the presence of azinophos methyl and diazinon in the Gorgan and Qareh Su rivers of Golestan and found experimentally that sub-lethal concentrations matching those in the wild led to adverse effects on a wide range of haematological parameters. Pourkhabbaz *et al*. (2016) found LC_{50} 96 h values for copper sulphate on fingerlings were 2.25 mg/l and mortality decreased with time and most deaths were in the first 24 hours. Daneshian *et al*. (2017) found that the LC_{50} 96 h was 20.01 and 31.39 mg/l for arsenic and cadmium respectively, considered as moderate sensitivity. Forouhar Vajargah and Hedayati (2017) found an LC_{50} 96 h of 0.342 p.p.m. for butachlor in fingerlings (and 0.76 p.p.m. in *Sander lucioperca* (pike-perch)). These findings suggested that this herbicide is moderately toxic and moderately irritating with clinical symptoms including protrusion of the eyes and irregular swimming. The roach was more sensitive than the pikeperch. Oveysi *et al*. (2017) analysed the vitellogenin gene structure during exposure to the endocrine disruptor pesticide atrazine. Vitellogenin expression is used to assess exposure to endocrine disruptors in the environment. Aghamirkarimi *et al*. (2018) showed that copper nanoparticles could cause a decrease in antioxidant enzyme activity, cause severe damage to liver tissue, and result in death. Bahrani *et al*. (2018) calculated the acute toxicity of the chemicals pretilachor and paracin to be 43.22 mg/l and 222.2 mg/l, respectively, in juveniles. Karimzadeh *et al*. (2018) investigated the toxic effects of zinc oxide nanoparticles on the oxidative stress enzymes in brain tissue over seven days and found an induction of free radical and oxidative stress. Khosravikatuli *et al*. (2018) exposed juveniles to sub-lethal levels of diazinon for 14 days and found the activated antioxidant condition returned to its natural state after a recovery period of 10 days. Mohammad Nejad Shamoushaki and Shahkar (2018) determined the LC_{50} 96 h for the insecticides chlorpyrifos and diazinon was 0.016 and 12.81 mg/l in fingerlings. Mohammadzadeh Baran *et al*. (2018) found that methyl tert-butyl ether, an octane booster used to increase oxygen levels in gasoline and a pollutant, caused extensive and varied tissue damage to gills, kidneys and liver and could eventually cause death. Mohammadzadeh Baran *et al*. (2019a) showed that methyl tert-butyl ether degraded the DNA of blood cells. Mohammadzadeh Baran *et al*. (2019b) examined the effects of methyl tert-butyl ether on enzyme activity. The antioxidant enzymes superoxide dismutase and catalase showed increased activity with increase in the octane booster levels, acting as a defense mechanism. Zolfaghari (2018) found mercury concentrations in muscle tissue of fish from the Anzali Wetland were lower than World Health Organization limits. Tajari *et al*. (2019) found that exposure to sublethal doses of the insecticide endosulfan stimulated the non-specific immune system.

Zahmatkesh *et al*. (2020) investigated the dietary use selenium nanoparticles (1 mg/kg) and chitosan oligosaccharide (600 mg/kg) against malathion-induced blood haematological and biochemical alterations, finding positive effects. Ettefaghdoost and Alaf Noveirian (2020b) measured the concentration of eleven heavy elements (As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Zn) in muscle tissue of 25 Caspian roach caught from the Siah Darvishan River, Gilan and found all except five heavy elements were below the standard approved by international organisations (FAO/WHO). The five were, in μg/g dry weight, nickel (0.584±0.026), arsenic (0.764±0.027), cadmium (0.296±0.024), lead (0.817±0.011) and manganese (1.665±0.166). Hosseinzade *et al*. (2021) reported on the effects of diazinon on the olfactory epithelium and genes related to olfactory signal transduction. Exposure included a significant decrease in the number of olfactory receptor cells, while goblet cells increased. In addition, Gprotein αi was significantly upregulated, whereas calmodulin-dependent kinase II α was significantly downregulated after seven days as compared to a control group. These results indicated that diazinon can impair olfactory function through an effect on the olfactory epithelium and olfactory signal transduction pathways.

Diet:-

Golshahi *et al*. (2009) found exposure to red light for 24 hours/day showed maximum growth in larvae and various other photoperiods showed no significant differences in survival rate.

Pouralimotlagh *et al*. (2010) investigated the replacement of fish oil by sunflower and soybean oil as dietary lipid sources and found these had no significant growth performance and health impacts. Akrami *et al*. (2011) investigated the effect of dietary mannan oligosaccharide on fry and found a positive correlation between growth performance, survival and supplementation level but none for salinity stress survival and body composition. A supplementation level of 2.0 g/kg was recommended for fry diets. Abolfathi *et al*. (2012) demonstrated compensatory growth dependent on duration of food deprivation, this knowledge allowing exploitation for increased growth rate and feeding efficiency in aquaculture. Kordi *et al*. (2012) studied diet supplementation of juveniles with L-carnitine, an amino acid compound, finding it had no effect on growth performance but it affected carcass chemical quality. Mohammad Nejad Shamoushaki (2012) found that an increase in feeding frequency did not affect growth and survival in young cultured fish. Mohammad Nejad Shamoushaki and Mazini (2012a) used probiotic bakery yeast (*Saccharomyces cerevisiae*) to introduce beneficial microflora to the digestive tract and give better growth; feeding in black tanks was more effective for growth too. Soleimani *et al*. (2012) found that fry fed a diet supplemented with prebiotic oligofructose had better growth condition including final weight, specific growth rate and condition factor compared to controls, and also higher resistance to salinity stress and higher survival. Soleimani et al. (2012) showed that dietary supplementation with the prebiotic fructo-oligosaccharide improved the innate immune response, stress resistance, digestive enzyme activities and growth performance of fry. Taheri and Aliasghari (2012) found that elongating a starvation period in fry resulted in a decrease in the compensation growth mechanism. Ahmadivand *et al*. (2013) looked at various levels of phosphorus in the diet of larvae in respect to growth and carcass composition, determining that growth performance measures were not enough and bone mineralisation also needed to be determined. Ahmadivand *et al*. (2013b) studied hatchery larvae fed a diet with a low phosphorus content, noting skeletal deformations with kyphosis being the most frequent abnormality. Fatahi and Hoseini (2013) investigated the use of tryptophan and betaine in diets, the latter having no effect while 0.25% tryptophan reduced mortality in fish exposed to copper pollution. Hoseinifar

et al. (2013) showed that fry fed galacto-oligosaccharide had improved growth performance, stress resistance, and modulation of intestinal microbiota by increasing lactic acid bacteria. Ahmadifar *et al*. (2014) found that fish oil could be completely replaced with alternative vegetable oils (soybean and sunflower) without seriously affecting growth performance and health of juveniles in aquaculture. Ahmadivand *et al*. (2014) detailed skeletal disorders in larvae, finding the highest incidence in fish with diets low in phosphorus. Akrami *et al*. (2014) fed betafin (extract of sugar beet molasses) to juvenile as a food attractant on growth, survival, body composition and resistance to stress, but there was no significant difference in most parameters and it was not recommended. Roosta *et al*. (2014) determined that fry fed vitamin C showed beneficial effects on the skin mucus immune parameters and on growth performance. Tajdar Nasrabadi and Akrami (2014) showed that 5g/kg of mannan oligosaccharide supplement in the juvenile diet improved growth performance and survival, allowing for cost compared with fructo-oligosaccharide.

Fatahi (2015) examined the effects of different levels of betaine and tryptophan on growth and resistance to salinity stress in juveniles. Tryptophan did not reduce food consumption meaningfully. Increased food consumption as a result of betaine did not show a significant effect on growth rate. At 12 p.p.t. no mortality occurred. At 20 p.p.t. 100% mortality occurred within six hours while with treatment 100% mortality occurred after 24 hours. At 16 p.p.t. the lowest mortality (16.66%) occurred with treatments containing 1% betaine and 0.5% tryptophan while the highest mortality (59.98%) occurred in the control group. Hoseinifar *et al*. (2015) carried out experimental studies on fry fed extract of the scud *Pontogammarus maeoticus*, finding better growth, immune response and resistance to salinity challenges. Roosta *et al*. (2015) found an increase in mucus immunity by means of disease decrease was obtained with vitamin C as an immune stimulant. Salmanian Ghahderijani *et al*. (2015) showed that dietary garlic supplements positively affected skin mucus immune parameters and growth parameters of fry. Shamloofar *et al*. (2015) evaluated the efficiency of the immune stimulant immunogen in young fish but found no advantage in growth and survival. Chitsaz *et al*. (2016) showed that the addition of the synbiotic biomin imbo to the diet of juveniles enhanced growth performance and feed efficiency, increased resistance to salinity stress and survival rate, stimulated beneficial intestinal flora, and immune responses were significantly higher. Ghorbani (2016) evaluated the effects of different dietary levels of protein (30, 35, 40 and 45%), fat (8, 12, 16 and 20%) and total energy (3,500, 4,000, 4,500 and 5,000 kcal/kg) on growth of fingerlings and found 30% protein, 16% fat and total energy 5,000 kcal/kg was suitable. Rufchaie *et al*. (2017) found that dietary administration of *Pontogammarus maeoticus* extract to fingerlings increased immune responses, salinity stress resistance, feed intake and growth performance. Rufchaie *et al*. (2018) evaluated gammarid extracts in the diet of fingerlings and found an increase in feed acceptability, and in various growth parameters and resistance against salinity stress because of suitable amino acid and fatty acid profiles. Rufchaie *et al*. (2017, 2017, 2019) investigated the use of dietary earthworm (*Eisenia fetida*) extracts on the growth performance, immune response and salinity stress resistance of fry and fingerlings and found it to be beneficial. Ghorbani *et al*. (2018) evaluated dietary energy levels (3,500-5,000 kcal/kg and 45% protein) on juveniles and found no effect on weight gain, specific growth rate, obesity coefficient, shelf life, feed conversion ratio and protein efficiency coefficient. Rastegari *et al*. (2018) studied the effect of different levels of peppermint (*Mentha piperita*) powder on growth and immune skin parameters of juveniles, finding gains in body weight and specific growth rate while feed conversion ratio decreased, and skin mucus protein levels and alkaline phosphatase and lysozyme activity

increased. Ghorbani *et al*. (2019) found the highest growth performance in fingerlings when fed a diet with 16% fat. Tarkhani *et al*. (2019) isolated host-associated probiotic lactic acid bacteria from the intestine of adult Caspian roach and compared efficacy with a commercially available probiotic strain (*Pediococcus acidilactici*) on the growth and feed utilisation, digestive enzymes and systemic and mucosal immune system of roach fingerlings. The host-associated probiotic lactic acid bacteria resulted in better immune competence and growth performance, and the aquaculture sector should probably focus on the development of probiotics isolated from cultured species instead of using terrestrial probiotics with greatly different requirements and environmental conditions.

Khanmohammadi Otaghsara *et al*. (2020) investigated the probiotic effects of isolated lactic acid bacteria (*Lactobacillus acidophilus*, *L. brevis* and *L. plantarum*) from kutum guts on *Escherichia coli* and *Pseudomonas aeruginosa*. The most inhibitory effect belonged to *L. acidophilus* on both *E. coli* and *P. aeruginosa*, *L. plantarum* had a moderate inhibitory effect on *P. aeruginosa* and *L. brevis* had no effect on both bacteria. Paknejad *et al*. (2020) concluded that dietary mint powder increased the growth and non-specific immunity of fish. Tarkhani *et al*. (2020) found beneficial effects of dietary supplementation with *Enterococcus faecium* strain CGMCC1.2136 isolated from adult roach on growth performance, proximate body composition, serum innate immune parameters and digestive enzymes activity in fingerlings.

Aquaculture:-

Malakpour Kolbadinejad *et al*. (2010) examined gradual salinity increase on osmoregulatory functions, conditions which mimicked stocking of hatchery-reared fish. The fish adapted to a wide range of salinities although survival rate at 15‰ was less than the control group. Malakpour Kolbadinezhad *et al*. (2012) found that juveniles used for re-stocking could adapt to a salinity increase after an initial non-lethal iono-osmotic perturbation. Mohammadnejad Shamoushaki *et al*. (2012) found maximum weight and length was better in fingerlings fed in black tanks. Mohammad Nejad Shamoushaki and Mazini (2012b) found the best temperature for growth and survival of fingerlings was 30ºC from a studied 26-32ºC range. Ahmadivand *et al*. (2013a) studied the stress of stocking density for larvae by examining growth and haematological parameters. Growth performance decreased with increasing density but haematological parameters were unchanged. Optimum stocking density was one larva per litre. Piri (2013) investigated the cultivation of fingerlings in earthen ponds with fresh or brackish water at 10,000, 15,000 or 20,000 fish per hectare, finding generally similar results with some differences in length, weight and condition factor. Egdery *et al*. (2014a, 2014b) gave some details of allometric growth and morphological development up to 80 days post-hatching, an understanding of which is necessary for aquaculture management.

Behzadi Mackvandi *et al*. (2015) used image analysis to record measurements on live fish and thus reduce loss from disease and death when fish were measured manually. The developmental osteological study of Hasanpour *et al*. (2015, 2016) could be used as an early indicator of non-optimal rearing conditions in hatcheries. Monajjemi (2015) found that the best conditions for rearing juvenile roach were 20-24ºC temperatures and feeding 2-4 times/day. Shahkar *et al*. (2015) found that growth performance in juveniles could be stimulated by using 24L and 18L:6D photoperiods without any significant stress response as measured by haematological parameters. Yaghoubi *et al*. (2015) detailed the histological development of the digestive tract from hatching to fingerling size. Bisheh *et al*. (2017) evaluated the ponds at the Sijaval Cultivation Center (or Bony Fish Farm or Bony Fish Reproduction Center, in Bandar-e Torkeman), where juveniles were cultured for release into the Gorgan River and the

physicochemical conditions were found to be suitable. Ermakov *et al*. (2017) gave test systems using mtDNA to identify rapidly *R. lacustris* and *R. rutilus* (in Russia). Imanpoor *et al*. (2018) showed that stocking density affected the growth (weight gain, feed conversion rate, specific growth rate) of juveniles but increasing the feeding frequency did not. The lowest levels of haematocrit were observed in a density of 10 fish/aquarium at two times/day feeding frequency.

Akhoundian *et al*. (2020) exposed mature females to varying photoperiod and temperature regimes and found photoperiod played a more important role in ovarian development than temperature. Earliest spawning occurred in fish exposed to 16L/8D and 20ºC and even fish at 14ºC matured and spawned earlier with longer day-length. Jebeleh *et al*. (2020) evaluated the diet of juveniles in earthen ponds at the Syjaval Bony Fish Farm over a four-month period from March to June. The highest and the lowest condition factors (K) were 1.196 and 0.633, respectively, while the highest dominance index was reported as 42.14 for Gastropoda and the lowest was 2.4 for aquatic insects. Gastropoda and crayfish were the major prey items, and organisms such as aquatic insects and bivalves were minor foods.

Chemical composition and food safety:-

Moeini and Daneshnuran (2001) and Moini *et al*. (2005) investigated the production of marinades using this fish and various recipes, examining their chemical composition over time and their comparative tastes. Chari Aliabad *et al*. (2019) applied four cooking methods (deep frying, baking, steaming and microwaving) to fillets and recommended baking for increased fatty acid levels and steaming for reduction in heavy metals.

Disinfection and healing:-

Ghelichpour and Eagderi (2012) found that formalin treatment (used to combat parasites and disinfect equipment in cultured fish) reduced saltwater tolerance in this species (fish are released in estuaries because of low water flow in the upper river and salt intrusion may give salinities >10‰). Hoseini *et al*. (2013) studied formalin toxicity finding recommendations in the literature for dosages of this disinfectant and therapeutic agent were not valid for fingerlings of this species, which was more susceptible. Hoseini and Nodeh (2013) found the LC_{50} 96 h for fingerlings exposed to formalin was 49 p.p.m. Farhangi *et al*. (2014) studied the effect of copper sulphate on this species as it is used as a disinfectant and algicide. The lethal concentration was 0.4 mg/l. High concentrations of this heavy metal caused convulsions, oedema, hyperemia, haemorrhages and kidney lesions. Ghelichpour *et al*. (2016) studied gill histopathology of fingerlings treated with potassium permanganate and formalin finding no difference in gill damage in short-bath treatments but more in long-bath formalin treatments. Sahraei *et al*. (2017) examined the effects of black powder seeds (*Nigella sativa* or fennel flower) in the diet of young fish, finding a positive effect on the antibacterial activity in the fish mucus.

Spermatology:-

Imanpour *et al*. (2009) examined the relationship between fish size and various spermatological parameters. Sperm volume did not increase with body length although gonadal weight did. Spermatocrit, sperm motility, sperm density, gonadosomatic index and haematocrit were not influenced by fish body size but sperm density decreased significantly with increasing gonadal weight.

Golpour and Imanpour (2010) studied relationships between seminal and blood plasma composition during the reproductive season, as part of improving artificial fertilisation. Golpour *et al*. (2011, 2013) found fish caught in March had better spermatological and biochemical characteristics than those caught in February and April. Golpour *et al*. (2014) showed that broodstock migrating in the middle of the spawning season had better semen quality than at other

times. Halimi *et al*. (2014) recorded quantitative characteristics and chemical composition of sperm in this species for use in artificial fertilisation.

Anaesthesia:-

Jahanbakhshi *et al*. (2014) showed that fish should be anaesthetised at higher doses of 2-phenoxyethanol, a glycol ether, for reduced stress as shown by blood parameters.

Conservation. Holčík and Oláh (1992) reported a catch of only 5 kg in the Anzali Talab for 1990, indicative of decline. This species has been cultured at Sad-e Sangar Fish Farm near Rasht (3 million larvae a year), at Astara and at Anzali on the Caspian among other localities (Mokhayer, 1972). In 1999-2000, 30 million juveniles were released into the Caspian Sea (*Iranian Fisheries Research Organization Newsletter*, 23:4, 2000). Adeli Mosabbab and Piri (2005) recorded the release of fry into the Gorgan River of the southeast Caspian Sea as 16,663 million in 2000, 19,119 in 2001, 12,263 million in 2002, 11,931 in 2003 and 10,413 in 2004, the decrease being due to a fall in capture of brood fish. Noroozi *et al*. (2006) detailed capture of brood stock from the Gorgan River estuary for release into 2 ha earthen ponds enriched with manure and fertiliser. The optimum temperature for spawning brood stocks was 12-17ºC, found in mid-March to late April. Pine branches were placed in the ponds as spawning sites. Ponds were stocked with 700 females averaging 150 g and 350 males averaging 100 g. Eggs hatched on the sixth day. Larvae were fed on natural zooplankton (Rotatoria and *Daphnia*) and artificial food.

Savenkova (1990) listed several reasons for reductions in catches in the Atrak River stock of Turkmenistan on the border with Iran and commented on the marketing of this species in southwestern Turkmenistan. These included ineffective fish passes, poor marketing strategies, and the low quality of fish reaching the spawning grounds. The Atrak River population could be conserved by regulating the discharge so that the spawning grounds flooded at the appropriate time (Petr, 1987). Beach seines with mesh sizes of 28 mm, 33 mm and 36 mm caught fish of ages 2.8 years, 2.9 years and 3.3 years respectively. These data indicated that 58.3%, 50.5% and 3.6% of the total catch were non-standard respectively. Seines with a cod end of at least 36 mm were recommended for stock protection (*Iranian Fisheries Research and Training Organization Newsletter*, 6:8, 1994). Catches were increasing with the rise of the Caspian Sea water level as noted above, indicating how natural events beyond human control could have a significant effect on stocks.

Hashemzadeh Segherloo *et al*. (2020) recommended in their population genomics study that the Aras River and sea-run *R. lacustris* of Iran be treated as two separate conservation units and the southeastern and southwestern Caspian Sea populations should be viewed as two potentially separate management units.

Listed as of Least Concern by the IUCN under *Rutilus caspicus* (downloaded 25 February 2019). Golpour and Imanpour (2010) considered this species to be threatened in Iran from overfishing and deterioration of spawning grounds. Robins *et al*. (1991) listed this species (under *Rutilus rutilus*) as important to North Americans. Importance was based on its use in aquaculture and as food, in sport and in textbooks and because it has been introduced outside its natural range. Everard (2006) is one book of many describing the biology and importance of the roach (as *Rutilus rutilus*).

Sources. Wossugh-Zamani (1991c) and Akbari-Pasand (1996) gave accounts of this species in Farsi.

Iranian material:- CMNFI 1970-0507, 3, not kept, Gilan, Caspian Sea at Hasan Kiadeh (37º24'N, 49º58vE); CMNFI 1970-0509, 3, 73.4-82.9 mm standard length, Gilan, Sefid River at

Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0510, 4, 58.6-83.8 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0531, 14, 65.5-115.8 mm standard length, Mazandaran, Larim River talab (36º46'N, 52º56'E); CMNFI 1970-0532, 1, 74.9 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0543A, 1, 119.4 mm standard length, Gilan, Caspian Sea at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0548, 1, not kept, Golestan, Qareh Su (no other locality data); CMNFI 1970-0549, 1, 109.7 mm standard length, Golestan, Qareh Su near Alm Imamzadeh (no other locality data); CMNFI 1970-0563, 5, 40.3-112.2 mm standard length, Gilan Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0565, 2, 42.4-45.8 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1970-0581, 1, not kept, Gilan, Caspian Sea near Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0583, 6, 35.7-84.9 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0590, 1, not kept, Mazandaran, Shesh Deh River near Babol Sar (ca. 36º43'N, ca. 52º39'E); CMNFI 1979-0431, 1, 157.0 mm standard length, Mazandaran, bazaar at Now Shahr (no other locality data); CMNFI 1979-0476, 23, 25.4-32.3 mm standard length, Golestan, Qareh Su near Kord Kuy (36º51'N, 54º05'E); CMNFI 1979-0477, 15, 26.5-39.7 mm standard length, Golestan, Khalij-e Gorgan at Bandar-e Shah (= Bandar-e Torkeman) (36º54'N, 54º02'30"E); CMNFI 1979-0685, 1, 45.6 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0689, 1, not kept, Gilan, Sefid River at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1979-0788, 2, 64.9-66.6 mm standard length, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0117, 1, 92.2 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0120, 1, 54.2 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1980-0126, 4, 162.2-178.3 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1980-0131, 1, 43.0, Iran, Caspian Sea basin (no other locality data); CMNFI 1980-0136, 4, 72.1-109.7 mm standard length, Mazandaran, Fereydun Kenar River estuary (36º41'N, 52º29'E); CMNFI 1980-0139, 1, not kept, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0140, 9, not kept, Gilan, Astara Talab close to sea (ca. 38º26'N, ca. 48º53'E); CMNFI 1980-0148, 1, 85.4 mm standard length, Gilan, Pir Bazar Roga River (37º21'N, 49º33'E); CMNFI 1980-0157, 2, 73.1-132.0 mm standard length, Golestan, Gorgan River estuary (36º59'N, 53º59'30"E); CMNFI 1980-0905, 9, 98.5-203.0 mm standard length, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E).

Genus *Scardinius*
Bonaparte, 1837

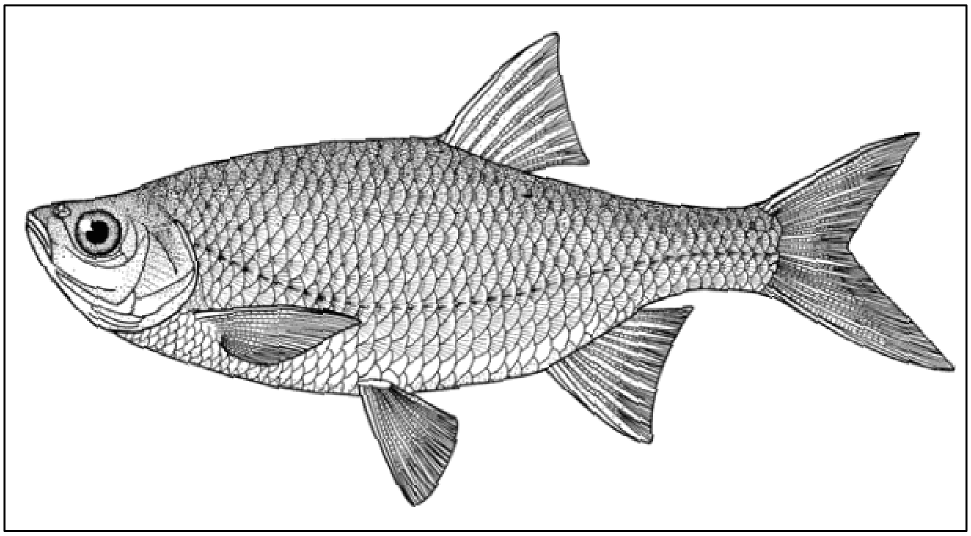
The genus contains perhaps 10 species and is found from the British Isles and the Iberian Peninsula throughout Europe to the Caspian and Aral Sea basins, with one species in Iran.

Howes (1981) placed this genus in *Rutilus* Rafinesque, 1820 on osteological grounds. Bogutskaya (1988) disagreed. *Scardinius* is usually separated from *Rutilus* by having two, as opposed to one, rows of pharyngeal teeth and a ventral keel on the body. Howes (1981) considered pharyngeal teeth to be of only species importance and the keel is variously developed in *Rutilus*.

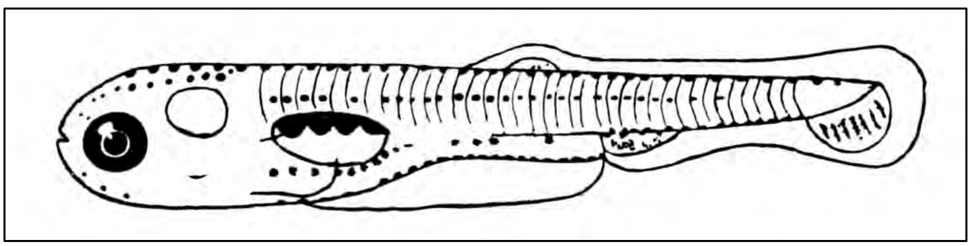
The genus is characterised by a pharyngeal tooth count of 3,5-5,3 with major row crowns laterally compressed and bearing 5-8 serrations, scales moderate in size in a complete lateral line, few, short gill rakers, a keel on the belly behind the pelvic fins covered with scales, a short gut

and light peritoneum, dorsal and anal fins of moderate length, dorsal fin origin well behind the origin of the pelvic fins, and a terminal and oblique mouth.

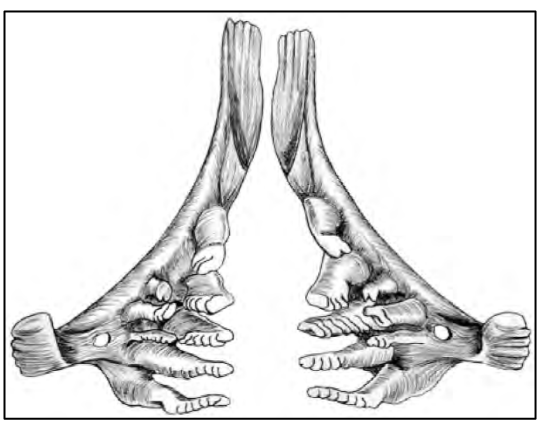
Scardinius erythrophthalmus
(Linnaeus, 1758)



Scardinius erythrophthalmus
Susan Laurie-Bourque @ Canadian Museum of Nature.



Scardinius erythrophthalmus fry, 7 mm, age two weeks, Russia, Volga River delta, after Kazanskii (1915).



Scardinius erythrophthalmus, pharyngeal teeth
(CC0, U.S. Geological Survey).

Scardinius erythrophthalmus, aquarium specimen
(Rotfeder Rudd, CC BY 2.0, rotated, cropped, background cleaned, Olaf Nies).

Scardinius erythrophthalmus
(CC BY-SA 2.5, U. S. Geological Survey, Noel Burkhead).

Scardinius erythrophthalmus, Ukraine, Southern Bug River
(*Scardinius erythrophthalmus* 2009 G1, CC0, rotated, George Chernilevsky).

Common names. Sorkh par, sorkh-e par or sorkh pareh (= red fin), mahi sorkh baleh (= red fin fish), mahi chesm ghermez (= red eye fish), redfish or scorpionfish (after Akbari Nargesi *et al*., 2018).

[Giziluzkac in Azerbaijan; Kizilkanat in Turkish (Çiçek *et al*., 2020); krasnoperka in Russian; rudd, pearl roach, redeye, redfin].

Systematics. See above under the genus. *Cyprinus Erythrophthalmus* was originally described from northern Europe. No types are known. This species is widely known to spawn with other cyprinid fishes making hybrids a common occurrence. Some Iranian material appears to be hybrids of this species and another, unknown parental species but this has not been investigated.

Key characters. This species is often confused with *Rutilus rutilus* and *R. lacustris* but can be distinguished by the posterior position of the dorsal fin (in relation to the pelvic fins), the belly keel, the upturned mouth, and the serrated pharyngeal teeth in two rows.

Morphology. The body is compressed and deep, although some young fish have a shallower body. The body is deepest over the pelvic fin origin or just in front of the dorsal fin. The back rises steeply behind the occiput and is compressed before the dorsal fin. The head is small, markedly shorter than body depth, and may be straight or concave dorsally. The chin can be oblique to almost vertical. The caudal peduncle is compressed and relatively deep. The snout ends abruptly. The mouth is terminal and oblique with its upper tip level with the upper third of the eye. Lips are thin. The eye is in the anterior half of the head and close to the snout. The dorsal fin is truncate or slightly emarginate and its origin is well behind the level of the pelvic fin origin. The depressed dorsal fin reaches back to a level above the mid-anal fin. The caudal fin is moderately to deeply forked with pointed lobes, the lower lobe often longer and more rounded. The anal fin is slightly emarginate or sub-truncate. The depressed anal fin does not reach back to the caudal fin base. The pelvic fin is rounded and almost reaches back to the anal fin origin or falls well short. The pectoral fin is rounded and falls short of, or almost reaches back to, the pelvic fin.

Dorsal fin with 2-4 unbranched and 7-10, usually 8 branched rays, anal fin with 3-4 unbranched followed by 9-13, usually 11, branched rays (Abdurakhmanov (1962) initially gave 8-9 anal fin branched rays for Azerbaijan fish but this may be a misprint as a subsequent table listed 9-11 rays), pectoral fin branched rays 13-16, and pelvic fin branched rays 7-9. Lateral line scales 36-45. The lateral line is decurved, nearer the abdomen than the back. There is a pelvic axillary scale. There is a strongly-developed, scaled keel between the vent and the pelvic fin base. Scales are squarish in shape, with sharp dorsal and ventral anterior corners, a wavy anterior margin, central focus, fine circuli which are coarser on the posterior field, and very few anterior and posterior radii (e.g., 2 anterior and 3 posterior primary radii reaching the focus from the margin). The scale margin is indented where radii terminate and the thick posterior radii are visible on the flank. Total gill rakers number 6-16 and are short and widely spaced, touching the adjacent one when appressed. Pharyngeal teeth are mostly 3,5-5,3 with variants 3,5-5,2, 3,5-5,1, 3,5-4,3, 2,5-5,3 and 2,5-5,2, narrow and elongate, slightly hooked and with about 5-8 strong serrations on each tooth. The gut is s-shaped with an anterior loop. Total vertebrae number 37-42. The chromosome number is 2n = 48-50 (Klinkhardt *et al*., 1995; Arai, 2011).

A single Iranian specimen had the following meristics:- dorsal fin branched rays 8, anal fin branched rays 10, pectoral fin branched rays 16, pelvic fin branched rays 8, lateral line scales 37, total gill rakers 10, pharyngeal teeth 3,5-5,3, and total vertebrae 39.

Sexual dimorphism. Males develop breeding tubercles on the head and body.

Colour. The back is blue-black to greenish- or olive-brown, the flanks are brassy and the belly silvery-white. Upper flank scales have dark bases. The tips of the caudal, anal and pelvic fins are a bright, blood red in the spawning season and the dorsal fin is black proximally and red distally. The iris is yellow to orange, or gold, with a red spot at the top. The peritoneum is silvery with scattered melanophores. Young are much less brightly coloured than adults.

Size. Attains 62.0 cm and 3.01 kg (Machacek (1983-2012), downloaded 27 July 2012).

Distribution. Found from the British Isles and north of the Pyrenees east to the Caspian and Aral Sea basins. It is recorded from the Lenkoran in Azerbaijan and, in Iran, from the Aras, Babol, Haraz, Pesikhan, Pir Bazar, Rasteh, Sefid and Sheikan rivers, the Anzali Talab, the Boojagh Wetland and a swamp near Hendeh Khaleh (Derzhavin, 1934; Holčík and Oláh, 1992; Karimpour, 1998; Abbasi *et al*., 1999, 2017, 2018; Abdoli, 2000; Naderi Jolodar and Abdoli, 2004; K. Abbasi, pers. comm., 21 February 2005; Patimar *et al*., 2010; Nikgoo *et al*., 2018).

Zoogeography. This species is part of a European and West Asian fauna whose origins may lie in a Danubian or Sarmatian fauna.

Habitat. This species is found in rivers, streams, lakes, dams, lagoons, ponds and marshes. Rudd can favour heavily overgrown areas (Shikhshabekov, 1979) and are generally found in shallow warm lakes or slow-moving rivers. They are usually inhabitants of midwater or near the surface but they overwinter in deep water. They are regarded as fairly hardy and are adapted to eutrophic, and presumably therefore, polluted waters. In Iranian waters its density was highest in the Anzali Talab (K. Abbasi, pers. comm., 21 February 2005) and the population there was stunted through poor habitat quality (Patimar *et al*., 2010).

Hatton et al. (2018) listed various mean parameters for this species such as the upper incipient lethal temperature (35.8°C), critical thermal maximum (33.5°C), critical thermal minimum (2°C), optimal growth temperature (21°C), final temperature preferendum (18.5°C), optimal spawning temperature (18°C) and optimal egg development temperature (21.8°C).

Age and growth. Nasri Tajan and Taati (2010) examined 181 fish from the Anzali Wetland finding age groups 0^+ to 2^+ years, with average fork length 133.99 mm and average weight 46.02 g, a significant difference in fork length between sexes, and fork length-total weight relationship $W = 0.0000087FL^{3.145}$, in males $W = 0.00000979FL^{3.119}$, and in females $W = 0.00000655FL^{3.205}$. Patimar *et al*. (2010) studied the stunted population in the Anzali Lagoon or Wetland and found maximum total length was 14.6 cm and maximum weight was 46.93 g. Males reached 4^+ years and females 5^+ years with 92.5% of fish age 2^+ to 3^+ years. Females were longer and heavier than males. Growth was isometric. There was no significant difference in condition coefficients between sexes and no temporal differences when considered separately for each date of sampling. The condition coefficient was highest in early May for males and mid-May for females and was lowest in early June for both sexes. Females dominated in older age classes and males in the younger. Moradinasab *et al*. (2012) found 141 Anzali Wetland fish, 6.4-17.7 cm total length, to have a *b* value in the length-weight relationship of 3.3613, positively allometric, a relative condition factor of 1.0 and a Fulton's condition factor of 1.4. Moradinasab *et al*. (2012) continued their study of Anzali Wetland fish and found an age range of 2^+ to 7^+ years for males and 3^+ to 7^+ years for females and 81.41% of age composition was in age groups 4-5^+ years. Total catch composition was 53.09% female, 42.59% male and 4.32% juvenile. The male:female sex ratio was 1:1.25, not significantly different. Growth was positively allometric with *b* values of 3.23 for males and 3.39 for females. Values respectively for males and females were relative weight (W_r) 1.007 and 1.095, instantaneous growth coefficient (G) 0.39 and 0.45, growth performance index (ϕ) 1.79 and 1.85, and growth performance (W_∞) 193.27 and 217.59. von Bertalanffy growth parameters were $L_\infty = 217.92$ mm, $K = 0.128$ year^{-1} and $t_0 = -1.07$ for males and L_c 232.4 mm, $K = 0.132$ year^{-1} and $t_0 = -1.29$ for females. These values and an adequate relative weight showed that biological conditions were suitable for this species in the Anzali Wetland in contrast to Patimar *et al*. (2010). Abbasi *et al*. (2018) found fish in their diet study in the Anzali Wetland to be 0^+ to 7 years old (and see below under **Reproduction**). Akbari Nargesi

et al. (2018) sampled the western Anzali Wetland and found, based on 127 fish, that 58.5% of fish were females and 7.41% were males.

Catches in the Anzali Wetland were higher using a red fyke net, compared to blue and black (Paighambari *et al*., 2014).

Sexual maturity was attained at 3-4 years in Dagestan at lengths of 17-29 cm and 80-530 g. A stunted form was found in rice paddies at an age of 2 years, 7.5-11.0 cm and 10-23 g (Shikhshabekov, 1979). Elsewhere life span is at least 17 years.

Food. Food is aquatic macrophytes as well as insect larvae, crustaceans, molluscs and more rarely fish eggs and fry. The young feed on zooplankton. Abbasi *et al*. (2018) examined diet in the Anzali Wetland and found fish to have an average gut length of 0.85, a feeding intensity of 224.9 and a coefficient of gut vacuity of 14.8%. There were 21 genera of phytoplankton from four phyla in the gut, of which *Nitzschia*, *Cyclotella* and *Scenedesmus* with an abundance of 26.0, 17.2 and 10.6% of total cell numbers were dominant, respectively, but only one type of zooplankton (*Philodina*, Rotatoria) with a low volume. Individuals fed on 13 types of benthic and aerial animals and two types of fish fry, of which Ostracoda, *Dreissena*, Hemiptera and the exotic prawn, *Macrobrachium nipponense*, were dominant with an abundance of 26.7, 19.1, 13.0 and 8.5% of their total weight, respectively. The fish also consumed seven aquatic plants, of which digested plants, *Spirogyra*, *Potamogeton* and *Ceratophyllum* were abundant with 42.9, 26.3, 14.7 and 13.7% of eaten plant volume. The results showed this species is an euryphagous and omnivorous fish in the Anzali Wetland.

Reproduction. The Iranian study of Patimar *et al*. (2010) found a reproductive period of mid-April to late May and showed that the gonadosomatic index peaked in mid-May for both sexes and then decreased sharply. Egg diameters reached 1.23 mm, maximum fecundity reached 59,620 eggs and relative fecundity 1,737.69 eggs/g. Akbari Nargesi *et al*. (2018) sampled the western Anzali Wetland and found the mean gonadosomatic index was 1.8 and 0.6 for males and females. MoradiChafi *et al*. (2018) examined 54 fish from the Anzali Wetland aged 2-7 years, total length 5.45-17.2 cm, mean 14.0 cm, with 4-5-year-old fish dominant. Absolute fecundity was 403-56,967 eggs, mean 18,510 eggs, and relative fecundity was 130-1,045, mean 401.0 eggs/g body weight.

Spawning took place at water temperatures of at least 18-20°C in June-July in Dagestan. Each female could be accompanied by two males, one on each side. Two batches of eggs may be spawned in this period (Shikhshabekov, 1979). In the Volga Delta, spawning took place from April until the end of June. Eggs attached to water plants. The young remained attached to vegetation until the yolk-sac was absorbed. Fecundity was up to 232,000 eggs with a diameter of 1.5 mm. Hatching took three days at 20-22°C.

Parasites and predators. Masoumian and Pazooki (1998) surveyed myxosporeans in this species in Gilan and Mazandaran provinces, finding *Myxobolus pfeifferi*. Sattari *et al*. (2004) recorded the nematode *Raphidascaris acus* larvae from this species in Gilan and Khara *et al*. (2006b, 2011) recorded this nematode in fish from the Boojagh Wetland of the Caspian coast. Daghigh Roohi (2016) recorded a *Dactylogyrus* sp. from fish in the Anzali Wetland. Mirhashemi Nasab *et al*. (2017) found *Diplostomum spathaceum* in fish from the Anzali Wetland with prevalence (46.66%) and range (one worm in a fish). Nikgoo *et al*. (2018) found fish from the Anzali Wetland hosted the nematodes *Agamospirura* sp., *Camallanus lacustris, Contracaecum squalii, Cosmocephalus obvelatus, Goezia* sp., *Hysterothylacium fabri, Molnaria intestinalis, Paraquimperia tenerrima, Rhabdochona denudata, Raphidascaris acus* and *Spiroxys contortus*, found in 92% of specimens with the highest and lowest rate of infection in summer and winter

respectively.

The Caspian seal, *Pusa caspica*, is a predator on this species (Krylov, 1984). Ashoori *et al*. (2017a) recorded this species as an occasional item in the diet of young black-crowned night herons (*Nycticorax nycticorax*)) in the Anzali Wetland.

Economic importance. Holčík and Oláh (1992) reported a catch of 98 kg in the Anzali Talab in 1990.

Robins *et al*. (1991) listed this species as important to North Americans. Importance was based on its use in aquaria and aquaculture, as food, in sport and in textbooks and because it has been introduced outside its natural range.

Experimental studies. None.

Conservation. Lelek (1987) classified this species as vulnerable in Europe. Kiabi *et al*. (1999) considered this species to be conservation dependent in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, medium numbers, habitat destruction, limited range (less than 25% of water bodies), absent in other water bodies in Iran, and present outside the Caspian Sea basin. Near threatened in Turkey (Fricke *et al*., 2007). Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Iranian material:- CMNFI 2008-0110, 1, 103.7 mm standard length, Gilan, swamp near Hendeh Khaleh (37°23'N, 49°28'E).

Genus *Squalius*
Bonaparte, 1837

There may be about 50 species in the chub genus *Squalius* found from England to Southwest Asia with 5 named species reported from Iran with perhaps others undescribed. The members of this genus were formerly placed in the dace genus *Leuciscus* Cuvier, 1816. The genus *Leuciscus* is not monophyletic based on allozyme data for a limited number of European taxa (Hänfling and Brandl, 2000). Schönhuth *et al*. (2018) noted that *Squalius* is the sister group to *Petroleuciscus* Bogutskaya, 2002

It has been suggested that species formerly considered to belong to the subgenus *Squalius* should be simply regarded as part of a *Leuciscus cephalus* complex characterised by serrated pharyngeal teeth in two rows (2,5-5,2) and an almost straight or convex anal fin margin. This complex would include *L. cephalus* (now several species), *L. gaderanus* and *L. lepidus* among Iranian species (Bogutskaya, 1994). Bogutskaya (2002), however, placed *L. persidis* and *L. ulanus* in a new genus *Petroleuciscus*, and placed *L. cephalus* (and by implication other *Squalius*) and *L. lepidus* in the genus *Squalius*, and this latter placement is followed here. Perea *et al*. (2010) found *Squalius* to have a Mediterranean group, an Euroasiatic group (central-east Europe, Asia and north of the Mediterranean area) and a Paratethys group (Black Sea and Anatolia).

Bogutskaya (2002) gave the characters of *Squalius* as numerous total vertebrae (commonly more than 40, up to 48), an increased number of sensory cephalic pores (up to 12-20 in the supraorbital canal) in most species, often fused and very expanded fourth and fifth infraorbitals, and a depressed neurocranium with a reduced interorbital septum. Other characters are a somewhat compressed body, moderate to large scales, a complete lateral line, no barbels, mouth terminal or subterminal, usually no notch in the upper jaw accommodating a tubercle on the lower jaw, thin lips with the lower one interrupted medially, a short dorsal fin without a thickened ray, a moderately long anal fin, long and hooked pharyngeal teeth in two rows (2,5-

4,2, 2,5-5,2 or 3,5-5,3 modally) usually with hooked tips and spoon-shaped crowns, short gut, no keel on the belly, and short and relatively few gill rakers.

Fishes in northern and western Iran, apart from the distinctive long-snouted chub *S. lepidus*, were formerly recognised in the literature as the wide-ranging European-Southwest Asian short-snouted chub *Leuciscus cephalus* with a subspecies *L. c. orientalis* (Nordmann, 1840) found in Southwest Asia, and later as *Squalius cephalus* or *Squalius orientalis*. This taxon is now divided into *S. berak* (Tigris River basin), *S. namak* (Namak Lake basin) and *S. turcicus* (Caspian Sea and Lake Urmia basins) (Esmaeili *et al*., 2016; Khaefi *et al*., 2016). *Squalius orientalis* Heckel, 1847 described from the Kueik River near Aleppo, Syria was possibly not intended by Heckel as an original species description; otherwise it is a homonym of *Leuciscus orientalis* Nordmann 1840 (*Catalog of Fishes*, downloaded 21 January 2021).

Chubs are fairly large cyprinids of economic and sporting importance in Southwest Asia, although not used as extensively as their relatives in Europe.

The following table summarises some key distinguishing characters of the Iranian species of *Squalius*.

Species/ Characters	Modal dorsal fin branched rays	Mouth	Lower jaw symphysis knob	Posterior tip flank scale	Anal, pelvic, caudal fins	Distribution
S. berak	8	Subterminal, terminal or lower jaw projects slightly	Absent	No bold blotch or bold blotch present	Hyaline or with a grey or yellow hue	Tigris River
S. latus	7	Lower jaw projects slightly	Present	No bold blotch	Orange to reddish	Hari River
S. lepidus	8-9	Elongate and pointed head with a projecting lower jaw	Present	No bold blotch	Reddish	Tigris River
S. namak	8-9	Subterminal or lower jaw projects slightly	Wide and thick	Bold grey or brown, roundish or crescent-shaped blotch	Orange to reddish	Dasht-e Kavir, Namak Lake
S. turcicus	8-9	Terminal to slightly or markedly subterminal;	Small	No bold blotch	Orange	Caspian Sea, Lake Urmia

Squalius berak
Heckel, 1843

Squalius berak, 137.0 mm standard length, ZM-CBSU J1740,
West Azarbayjan, Little Zab River between Piranshahr and Sardasht. Hamid Reza Esmaeili.

Common names. Mahi-ye sefid rudkhanehi or mahi-e-sephid-e-roodkhaneie (= white river fish) in Khuzestan, aroos or arus mahi (= bride fish).

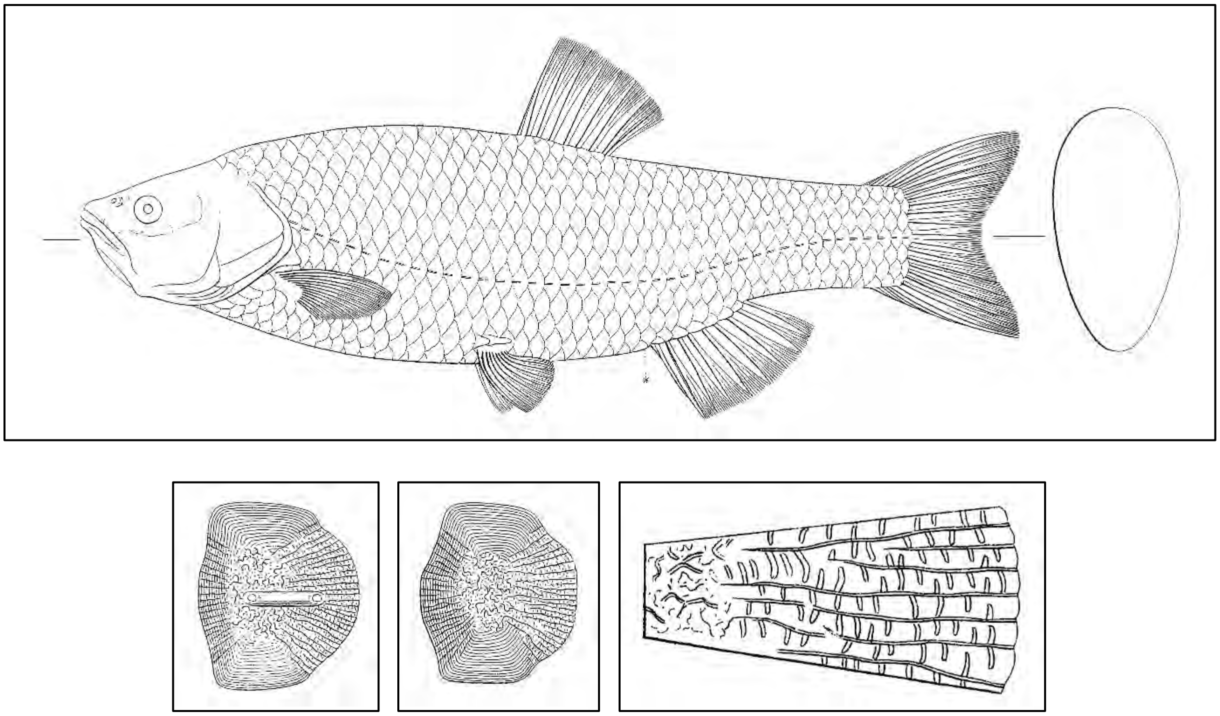
[Berak (meaning breast perhaps in allusion to the broad and fleshy chin (Heckel, 1843b)), baeaan, barayan, bir-aan siphaloos, at Aleppo, all in Arabic; Mesopotamian chub; riverine whitefish (Darvishi *et al*., 2018)].

Systematics. *Squalius berak* is now recognised as a distinct species (Doadrio and Carmona, 2006; Turan *et al*., 2009; Bogutskaya and Zupančič, 2010; *Catalog of Fishes*, downloaded 15 May 2018). It was originally described from Aleppo, Syria. The taxon appeared as a name only and was spelled *Berag* on p. 1041 of Heckel (1843b).

Squalius cephalopsis Heckel, 1843 described from "Aleppo" and *Squalius orientalis* Heckel, 1847 described from "Flusse Kueik bei Aleppo" (the latter possibly not meant by Heckel to be an original species description) are presumably synonyms, as used for Iranian Tigris River basin fish, of *Squalius berak*.

Six syntypes of *Squalius berak* are in the Naturhistorisches Museum Wien under NMW 48915 and three syntypes are in the Senckenberg Museum Frankfurt under SMF 469, formerly in NMW, and three syntypes of *Squalius cephalopsis* are under NMW 49438 and two other syntypes are under NMW 49440 (Eschmeyer *et al*., 1996). The Vienna catalogue listed six specimens as *Squalius berak* and two specimens as *Squalius cephalopsis* but the Vienna card index in 1997 agrees with Eschmeyer *et al*. (1996) for the NMW specimens.

Older works cited below, for example in **Distribution**, appeared under the names *Leuciscus cephalus* or *L. c. orientalis*.

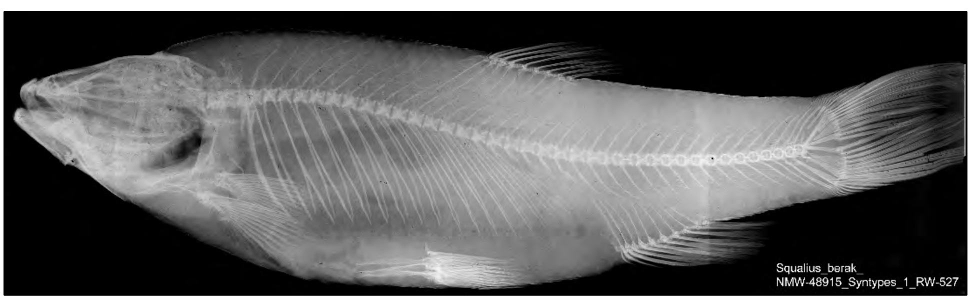


Squalius berak,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line (regenerated), and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Squalius berak, syntypes, NMW 48915, Naturhistorisches Museum, Wien.

Squalius berak, syntypes, NMW 48915, Naturhistorisches Museum, Wien


Squalius berak, syntype, NMW 48915, Naturhistorisches Museum, Wien.



Squalius berak, syntype, NMW 48915, Naturhistorisches Museum, Wien.

Key characters. This species is distinguished by the upper lip projecting beyond the lower lip (although this varies with some having the lower lip projecting or lips equal), no knob on the lower jaw synthesis, head blunt and deep, pelvic, anal and caudal fin rays hyaline, grey or yellow, the posterior tip of the flank scales without a bold blotch (present in some), and distribution in the Tigris River basin.

Morphology. The body is rounded and moderately deep, being deepest in front of the pelvic fin origin. The predorsal profile is gently convex and a nuchal hump is present in some fish. The dorsal head profile is concave or straight. The abdomen between the anus and the

posterior pelvic fin base is compressed. The caudal peduncle is compressed and deep. The snout tip is slightly pointed. The eye is positioned well into the anterior half of the head. The mouth is oblique, terminal, or the upper lip projects, or usually slightly subterminal or lips equal, and the mouth extends back to a level between the nostril and the eye. Lips are moderately thick and the upper lip is thickest at its centre. Fin rays are thin and not fleshy (Turan *et al*., 2017). The dorsal fin margin is straight. The dorsal fin origin lies posterior to the level of the pelvic fin origin. The depressed dorsal fin extends back level with the anal fin origin. The caudal fin is shallowly forked and has pointed tips. The anal fin margin is straight, emarginate or slightly rounded. The anal fin does not extend back to the caudal fin base. The pelvic fin is rounded and does not extend back to the anal fin origin. The pectoral fin is rounded and does not extend back to the pelvic fin origin.

Dorsal fin unbranched rays 3, branched rays 7-8, usually 8, anal fin unbranched rays 3, branched rays 7-9, usually 8 or 9, pectoral fin branched rays 14-19, and pelvic fin branched rays 7-10, usually 9. Total lateral line scales 40-46, scales above lateral line 8, scales below lateral line 3-4, scales around caudal peduncle 15-17, mode 16, and predorsal scales 18-21. Scale shape is squarish with a gently rounded posterior margin, straight to gently rounded dorsal and ventral margins and a protruding central part to the anterior margin with shallow indentations above and below. The anterior margin may be wavy. The anterior scale corners are abrupt but gently rounded. The focus is almost central and may be broken up into irregular lines. Radii are moderate to numerous on the anterior and posterior fields. Circuli are fine and numerous. Total gill rakers number 7-13, mode 9, anterior rakers being stubby, and the longest raker touching the one below when appressed. Pharyngeal teeth number 2,5-5,2, presumably with variants as seen under *S. turcicus*, and teeth are hooked at the tip and strongly serrated below it. The fifth tooth may be reduced to a nub. Total vertebrae number 40-43. Four of the six syntypes of *S. berak*, NMW 48915, have 41(3) or 42(1) vertebrae (the remaining two too faint to count). Poria *et al*. (2014) gave details of meristic and morphometric characters of fish from Shohaday-e Songhor Dam in Kermanshah Province.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(1) or 8(12), anal fin branched rays 7(1), 8(4) or 9(8), pectoral fin branched rays 14(1), 15(1), 16(3), 17(4), 18(-) or 19(1), pelvic fin branched rays 7(1), 8(3) or 9(9), lateral line scales 40(1), 41(3), 42(2), 43(3), 44(3), 45(-) or 46(1), total gill rakers 7(1), 8(2), 9(6), 10(2), 11(1), 12(-) or 13(1), and total vertebrae 41(6), 42(1) or 43(1), including 4 syntypes.

Sexual dimorphism. Unknown.

Colour. Esmaeili *et al*. (2016) described live fish as having a head and body silvery brown, darker on the back, and the belly white. There is a faint dark flank stripe. The posterior scale margins on the flank have a few grey pigments but the tip lacks any strong pigmentation. Anal fin rays are orange in live fish, greyish in preservative (Turan *et al*., 2017). Scale pockets are well-pigmented above the lateral line, with a bold, brown or black, crescent-shaped, vertically elongated or roundish anterior scale mark on scales below the lateral line. A few, very small spots may be on the mid-scale. Free margins of scales above the lateral line are pale. The pectoral, pelvic, anal and caudal fin rays are orange, and caudal fin rays have some black pigments. Dorsal fin membranes are hyaline with dark-grey rays. Preserved fish have the head and body pale brown, darker on the back, and can be quite dark. The pigment is lighter below the lateral line. Dorsal and caudal fins have blackish rays and hyaline membranes and the pectoral, pelvic and anal fin rays are whitish and the membranes yellowish. The peritoneum is black.

Size. Reaches 37.5 cm total length (Sadeghinejad Masouleh and Radkhah, 2018).

Distribution. This species is found in the Quwayq, Euphrates and Tigris River basins (Turan *et al*., 2017) with earlier records under *Leuciscus* (or *Squalius*) *cephalus* and *L. c. orientalis*. In the Tigris River basin in Iran in the Ab-barik, Ab-e Bazoft, Ab-e Jahan Bin, Armand, Arvand, Avachar, Avar, Badin Abad, Baneh, Boeen, Chameshk, Chamzarivar, Choman, Dez, Dinorab, Dinvar, Gahar, Gamasiab, Gangir, Gaveh, Haramabad, Jahanbin, Kalwi, Kangavar Kohneh, Karkheh, Karun, Kashkan, Khersan, Khorram (Khorramabad), Kiar, Little Zab (or Zab-e Kuchek), Marun, Qareh Su, Qaveh, Qeshlaq, Razavar (= Raz Avar), Simareh, Sirvan, Sulgan, Zanoschay and Zemkan rivers, sarabs in Kermanshah, in the Shohadaye Songhor Dam in Kermanshah and the Qeshlaq Dam, Kordestan, Lake Zaribar, and the Agh-Gol, Gamasiab and Haramabad wetlands in Hamadan Province (Barzegar and Jalali Jafari, 2006; Biokani *et al*., 2011; Bahrami Kamangar *et al*., 2012a; Bozorgnia *et al*., 2012; Sedaghat *et al*., 2012; Biukani *et al*., 2013; Dadashi *et al*., 2014; Pooria *et al*., 2014; Ramin *et al*., 2014; Reyahi-Khoram *et al*., 2014; Alizadeh Marzenaki *et al*., 2016; Khaefi *et al*., 2016; Darvishi *et al*., 2018; Maleki *et al*., 2018; Mouludi-Saleh and Keivany, 2018b; Sadeghinejad Masouleh and Radkhah, 2018; Hasankhani *et al*., 2019; Eagderi *et al*., 2020; Nasri, 2021).

Zoogeography. See under the genus above and under *S. turcicus* below.

Habitat. This species is found in rivers, streams, lakes, dams and springs. Esmaeili *et al*. (2016) stated that it is found in small to medium streams mostly in mountain and hilly areas as shown below.

Habitat of *Squalius berak*, West Azarbayjan, Little Zab tributary, Hamid Reza Esmaeili.

Age and growth. Sedaghat *et al* (2012) examined 60 fish identified as *Squalius cephalus*, 13.8-29.5 cm total length, from the Gamasiab River, Hamadan and found ages 1 to 4 years, with the 1-year age group most frequent (45.16%) and the 4-year age group least frequent (12.9%), maximum size was 29.5 cm and weight was 271.1 g, mean condition factor was 875 g/cm, and length-weight relationship showed positive allometric growth ($W = 0.006TL^{3.97}$). Pooria *et al*. (2014) found 113 fish identified as *S. cephalus*, 16.7-25.4 cm total length, from the Shohadaye Songhor or Shahda Dam in Kermanshah Province had a mean condition factor of 1.65 for males and 1.63 for females, not significantly different, the age range was 2 to 6 years, the male:female

sex ratio was 1:0.24, length-weight relationships were W = 7e-06L3.112, 4e-05L2.83 and 9e-06L3.08 for males, females and the population, and fish in the dam attained higher lengths compared to fish of the same age range in other waters, possibly because of better environmental and food supply conditions. Poria *et al*. (2014) reported age groups 2^+ to 5^+ years for this dam. Mouludi-Saleh and Keivany (2018b) examined 23 fish, 2.7-7.2 cm total length, from the Ab-barik River and found a *b* value of 3.14. Sadeghinejad Masouleh and Radkhah (2018) examined 62 fish, 11.2-37.5 cm total length, from the Kashkan River and found growth was positively allometric. Hoseinpour *et al*. (2019) studied the effect of wastewater on 280 fish identified as *S. cephalus* from the Gheshlagh (= Qeshlaq) River. The upstream, high water quality locality had a male:female sex ratio of 1:1.86 while the downstream, polluted locality had 1:0.61, both significantly different from the expected 1:1 ratio. Age was 0^+ to 5^+ in both localities. Downstream fish were larger and heavier than upstream fish. In the von Bertalanffy growth equation, for the whole river, the average asymptotic length was 28.2 cm for males and 35.5 cm for females, and overall condition factor was 1.53 for males and 1.5 for females, being significantly larger in most age classes in upstream fish. Differences between the two localities were attributed to wastewater input. Eagderi *et al*. (2020) examined 64 fish, 5.42-19.02 cm total length, from the Baneh, Choman, Gaveh and Khersan rivers and found a *b* value of 3.14, positively allometric. Zare-Shahraki *et al*. (2020) measured 25 fish, 9.0-17.0 cm total length, from the Karun River system and recorded a *b* value of 3.25.

Life span is 7 years in the Savur stream in the Tigris River basin of southeast Anatolia (Ünlü and Balcı, 1993a, 1993b), and over 8 years in the Euphrates River in Turkey (Özdemir and Şen, 1986) for fish identified as *L. c. orientalis*.

Food. Presumably similar to other chubs.

Reproduction. Ünlü and Balcı (1993a, 1993b) found spawning to take place from May to late June in southeast Anatolia in the Savur Stream, a tributary of the Tigris River. Fecundity reached 20,140 eggs and egg diameter 1.5 mm. Equations for the relationship between fecundity (F) and length (FL), weight (W) and ovary weight (GW) were given as $F = 0.0458FL^{2.3680}$, $F = 270.96W^{0.7912}$ and $F = 1888.86GW^{0.8163}$.

Iraqi fish attained sexual maturity in 3 years at 20 cm length and 700 g weight, spawning in March and April and depositing eggs in shallow water on gravel (Al-Rudainy, 2008).

Parasites and predators. Daghigh Roohi *et al*. (2015) recorded the first report of *Pomphorhynchus laevis*, an acanthocephalan, from fish identified as *Squalius cephalus* in the Gamasiab River. Maleki *et al*. (2018) reported metacercariae of the trematode *Clinostomum complanatum* from fish identified as *S. cephalus* in the Qeshlaq River basin.

Economic importance. Listed as economically important in the Turkish Euphrates River as *L. cephalus orientalis* (Özdemir and Şen, 1986).

Experimental studies. None.

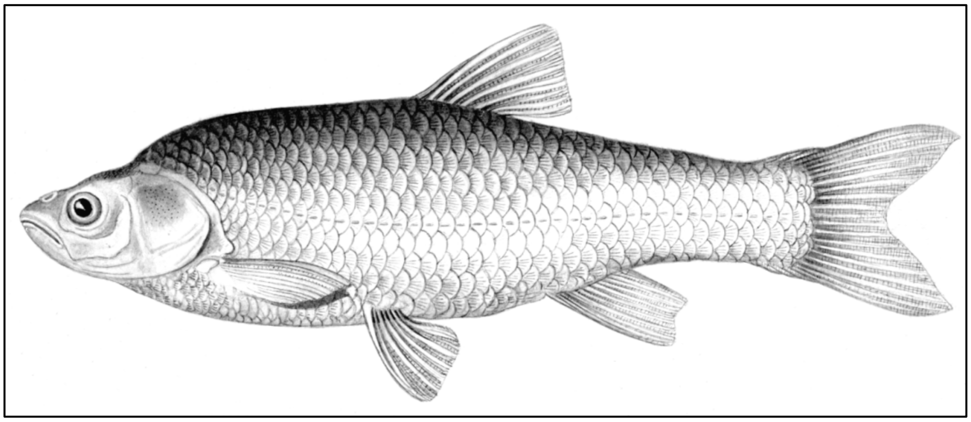
Conservation. Listed as of Least Concern by the IUCN (downloaded 15 February 2019).

Sources. Iranian material:- CMNFI 1979-0276, 1, 59.7 mm standard length, Lorestan, Chameshk River (ca. 33º19'N, ca. 47º53'30"E); CMNFI 2007-0099, 3, 34.7-35.5 mm standard length, West Azarbayjan, Kalwi Chay west of Mahabad (ca. 36º35'N, ca. 45º25'E); CMNFI 2007-0109, 1, 101.1 mm standard length, Kordestan, Qeshlaq River basin (ca. 35º16'N, ca. 47º01'E); CMNFI 2007-0113, 1, 99.5 mm standard length, Kermanshah, Qareh Su River tributary (ca. 34º25'N, ca. 47º01'E); CMNFI 2008-0102, 2, 179.4-266.0 mm standard length, Kermanshah, sarabs near Kermanshah (no other locality data); CMNFI 2008-0132, 1, 207.5 mm standard length, Khuzestan, neighbourhood of Ahvaz (no other locality data); CMNFI 2008-

0182, 1, 51.5 mm standard length, Chahar Mahall and Bakhtiari, Ab-e Bazoft Sofla (31º38'06"N, 50º28'30"E); CMNFI 2008-0185, 2, 51.4-71.6 mm standard length, Chahar Mahall and Bakhtiari, Sulgan River (31º30'N, 50º50'E); CMNFI 2008-0191, 1, 53.4 mm standard length, Chahar Mahall and Bakhtiari, Ab-e Bazoft (31º38'06"N, 50º28'30"E).

Comparative material:- BM(NH) 1974.2.22:71-72, 2, 68.0-93.1 mm standard length, Iraq, Baghdad (33º21'N, 44º25'E); BM(NH) 1974.2.22:74, 1, 152.1 mm standard length, Iraq, Greater Zab near Aski Kalak (ca. 36º16'N, 43º39'E); BM(NH) 1974.2.22:75, 1, 154.0 mm standard length, Iraq, Qizilja River, Lesser Zab (no other locality data).

Squalius latus
Keyserling, 1861



Squalius latus, 16.7 cm total length, Turkmenistan, Murghab River, after Berg (1948-1949).

Squalius latus, Razavi Khorasan, Hari River, after Jouladeh-Roudbar *et al*. (2020).

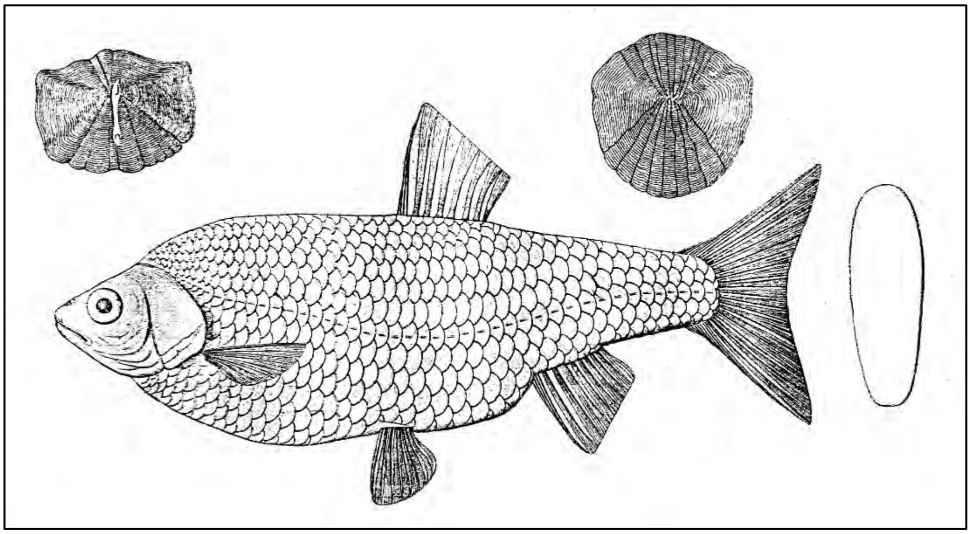
Common names. Aroos or arus mahi-e Harirud (= Hari River bride fish).

[Zakaspiiskii elets or Transcaspian dace in Russian; eastern asp, Hari asp, Murgab dace].

Systematics. *Squalius latus* was described from the “Fluss. Heri-Rud bei Herat” (now in Afghanistan, then in Persia). No types were kept.

Squalius transcaspiensis Berg, 1898 from “Habitat in flum. Tedschent, prope Aschabat in provincia Transcaspica” is a synonym. The type locality is presumably the Tedzhen River in Turkmenistan (not Iran as given in Eschmeyer *et al*. (1996)) although Ashkhabad is not on the Tedzhen River. Many syntypes are in the Zoological Museum of Moscow State University (MMSU or ZMMU) according to Eschmeyer *et al*. (1996) but not found in 2002 (*Catalog of Fishes*, downloaded 7 September 2018). Possibly a subspecies of *Squalius lehmanni* (Brandt,

1852) according to Nikol'skii (1938) and Svetovidova (1967) or of *Leuciscus leuciscus* (Linnaeus, 1758) according to V. V. Kafanova (cited in Bogutskaya, 1994). Bogutskaya (1994) considered *S. latus* to be distinct. Jouladeh-Roudbar *et al*. (2020) re-affirmed its place in the genus *Squalius* based on unpublished molecular and morphological data as it had previously been under *Leuciscus*.



Squalius latus, after Keyserling (1861).

Key characters. This species is distinguished by a dorsal fin branched ray count modally 7 and distribution in the Hari River basin.

Morphology. The body is rounded and can be fairly deep. The body is deepest in front of the dorsal fin over the pectoral fin level. The predorsal profile is convex. A nuchal hump is present in larger fish. The mouth is oblique, terminal and extends back to the level of the nostrils or the anterior eye margin. The lower jaw can protrude slightly. The rear of the eye is at the beginning of the anterior half of the head. The dorsal fin margin is straight to slightly convex. The dorsal fin origin is behind the level of the pelvic fin origin. The depressed dorsal fin extends back to a level just behind the origin of the anal fin. The caudal fin is moderately forked with pointed lobes. The anal fin margin is straight to slightly concave. The anal fin does not reach back to the caudal fin. The pelvic fin is rounded and does not reach back to the anal fin origin. The pectoral fin is rounded and almost reaches back to the pelvic fin origin in some fish.

Dorsal fin unbranched rays 3 and branched rays 7-9, usually 7, anal fin unbranched rays 3 and branched rays 7-10, pectoral fin branched rays 13-16, and pelvic fin branched rays 7-10, usually 8. Lateral line scales 39-47. A pelvic axillary scale is present. Scales are rounded to squarish. Flank scales have a rounded posterior margin, less rounded dorsal and ventral margins, and a gently rounded anterior margin with some small indentations. Scales bear a moderate number of anterior and posterior radii, have numerous circuli and a sub-central anterior focus. Total gill rakers number 8-11 and reach the raker below when appressed. Pharyngeal teeth are usually 2,5-5,2, with variants 2,5-5,1, 1,5-5,1, 3,4-4,2, 3,5-5,2 or 2,5-4,2 and have narrow cutting edges on each side of a shallow groove below a hooked tip and, in larger fish, some teeth are serrated below the tip. Total vertebrae number 39-41.

Meristic values for fish from the Tedzhen (= Hari) River, part of which is the Iran-Afghanistan border are:- dorsal fin branched rays 7(12), anal fin branched rays 7(1), 8(6) or 9(5),

pectoral fin branched rays 15(6) or 16(6), pelvic fin branched rays 7(1) or 8(11), lateral line scales 39(1), 40(1), 41(2), 42(2), 43(1), 44(2), 45(1), 46(1) or 47(1), total gill rakers 8(2), 9(1), 10(5) or 11(4), pharyngeal teeth 2,5-5,2(3), and total vertebrae 39(4), 40(6) or 41(3) (includes data from x-rays of ZISP 18361 (x-rays only seen) and ZISP 11047).

Sexual dimorphism. Unknown.

Colour. The back and upper flank are reddish-brown or with a bluish sheen, the flanks yellowish and the belly silver. The dorsal and caudal fins are yellowish-brown and the other fins are reddish. The base of all fins becomes bright orange during spawning.

Size. Reaches 26.7 cm.

Distribution. This species is found in the Tedzhen River (= Hari River in Iran) and the Murgab River to the east in Afghanistan and Turkmenistan. Eagderi *et al*. (2020) is a recent Iranian record.

Zoogeography. This species is part of a complex of species found from Western Europe to Siberia. Its origins may lie in a Ponto-Caspian-Aralian refugium, becoming isolated and speciating in the eastern part of this area.

Habitat. This species is found in rivers but details of habitat are unknown.

Age and growth. Eagderi *et al*. (2020) examined 12 fish, 7.45-16.25 cm total length, from the Hari River and found a *b* value of 3.11, positively allometric.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported from Iran.

Economic importance. None.

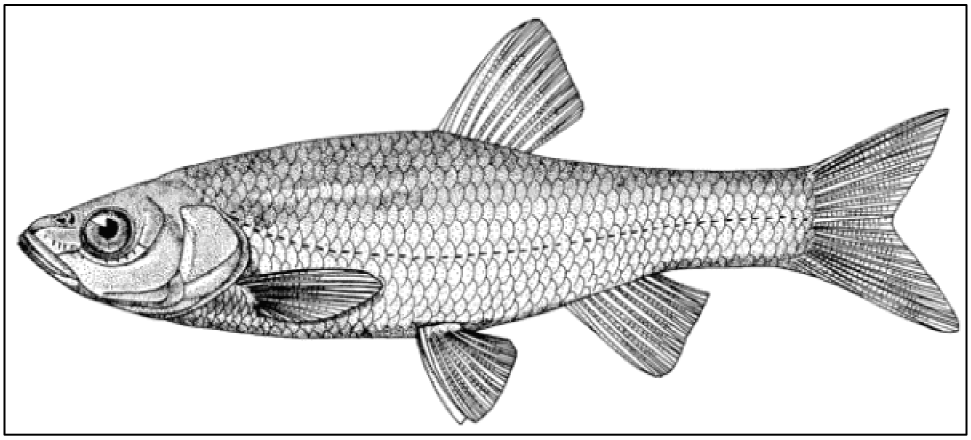
Experimental studies. None**.**

Conservation. Numbers and habitat requirements are unknown and so a conservation assessment cannot be made. Mousavi-Sabet *et al*. (2018) noted there have been no new records for many years, probably since the collection of the type specimens, and no records from Iranian waters (but see Eagderi *et al*., 2020). Jouladeh-Roudbar *et al*. (2020) listed it as Data Deficient.

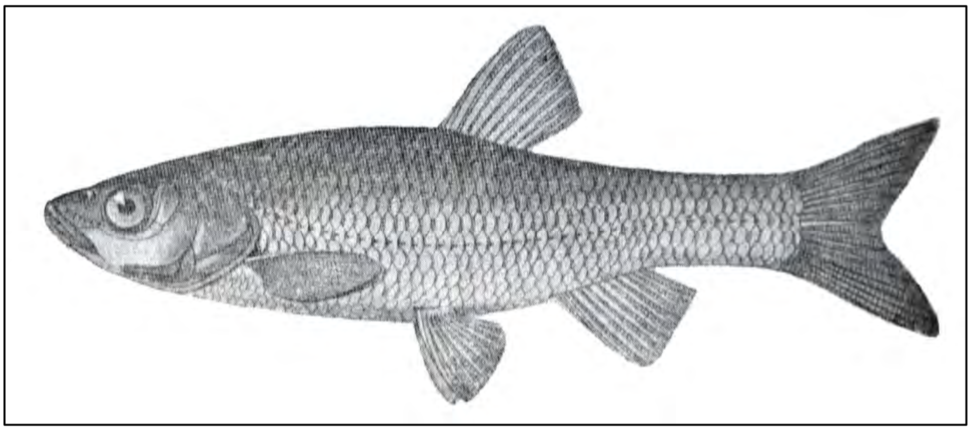
Sources. Iranian material:- None.

Comparative material:- ZISP 10357a, 1, 63.2 mm standard length, Turkmenistan or Afghanistan, Tedzhen River (no other locality data); ZISP 10359, 4, 93.4-130.5 mm standard length, Turkmenistan or Afghanistan, Tedzhen River (no other locality data); ZISP 10360, 6, 58.4-122.0 mm standard length, Turkmenistan or Afghanistan, Tedzhen River (no other locality data); ZISP 10419, 1, 107.6 mm standard length, Turkmenistan, Iolotan near Merv (37º18'N, 62º21'E); ZISP 11047, 1, 133.2 mm standard length, Turkmenistan, Tedzhen River (no other locality data).

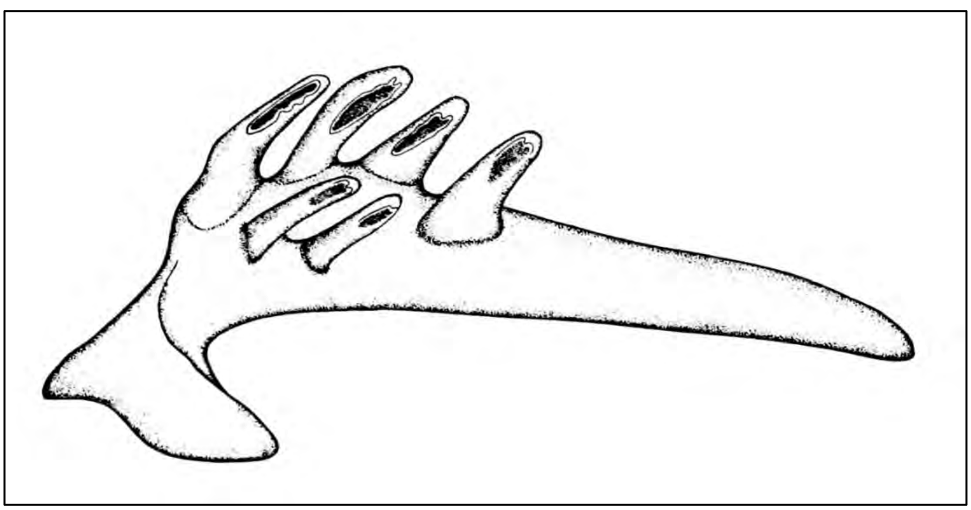
Squalius lepidus
Heckel, 1843



Squalius lepidus
Susan Laurie-Bourque @ Canadian Museum of Nature.



Squalius lepidus, 13.2 cm total length, ZISP 24055, Iraq, Mendeli, after Berg (1949).



Squalius lepidus, pharyngeal teeth, Freidhelm Krupp.

Squalius lepidus, Iran, Gamasiab River, May 2008, Keyvan Abbasi.

Squalius lepidus, Kordestan, Gaveh River (above) and Kermanshah, Dinvar River (below), after Jouladeh-Roudbar *et al*. (2020).

Common names. Kavar or kawar (= probably from kahvar (like wheat straw), Y. Keivany, pers. comm., 25 September 2018), aroos or arus mahi (= bride fish).

[Bara'an or bir-aan abiadh in Arabic; Akbalık in Turkish (Kaya *et al*., 2016); long-snouted chub, Mesopotamian pike chub, Tigris dace].

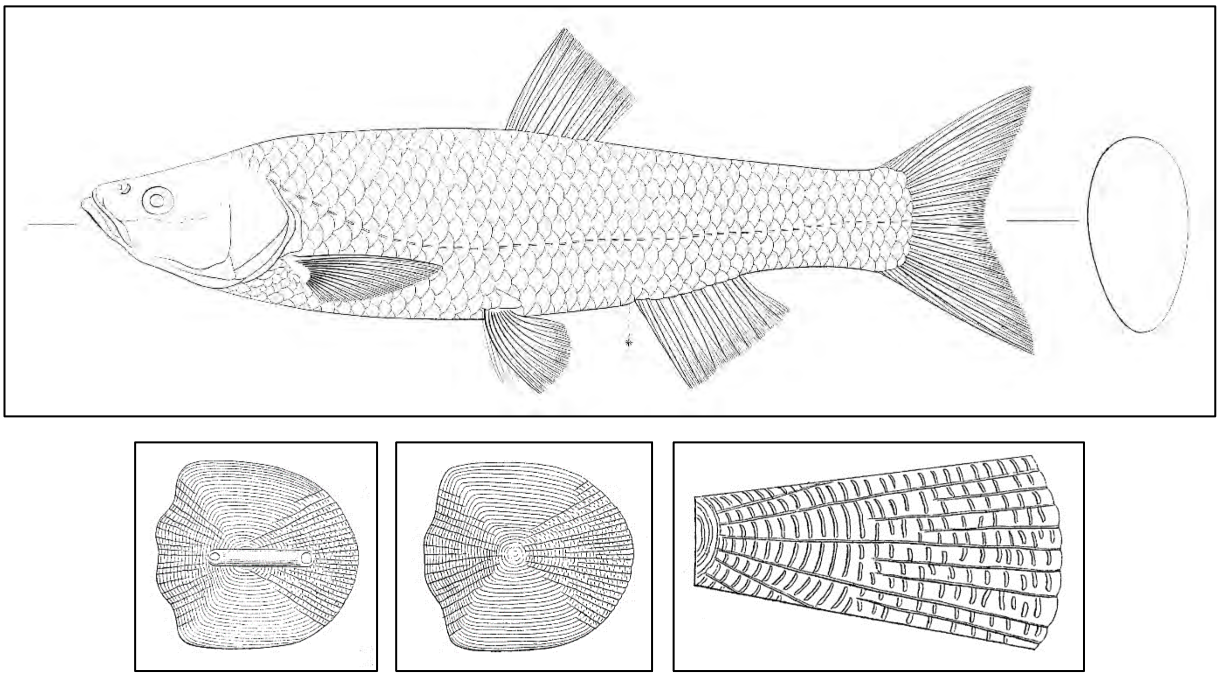
Systematics. *Squalius lepidus* was originally described from the "Tigris bei Mossul" (Heckel, 1843b).

Alburnus doriae De Filippi, 1865 and *Alburnus maculatus* Keyserling, 1861 are synonyms according to Coad (1982c, 1985) but these are errors. Note also that *Alburnus maculatus* Kessler, 1859 from the Salghir River at Simferopol, Crimea, Ukraine preoccupies *Alburnus maculatus* Keyserling, 1861 and is a distinct species of *Alburnoides* (Bogutskaya and Coad, 2009).

The syntypes of *Squalius lepidus* are in the Naturhistorisches Museum Wien according to Krupp (1985c) under NMW 49342, 2 specimens, 228.3-240.2 mm standard length as measured by me and NMW 49343, 2, 82.4-107.3 mm standard length, collected by Th. Kotschy in 1843. Bogutskaya (1994), however, listed a lectotype (237.0 mm standard length) and five paralectotypes under NMW 49342, two paralectotypes under NMW 49343, and one paralectotype under SMF 847 (the paralectotypes measure 90.8-233.8 mm standard length).

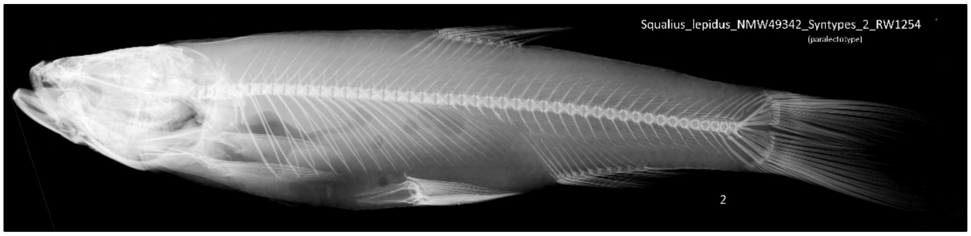
Eschmeyer *et al*. (1996) also listed one syntype under NMW 49344 and this specimen (166.5 mm standard length) appears in the 1997 Vienna card catalogue as a syntype along with the other four fish mentioned by Krupp (1985c). One syntype is in the Senckenberg Museum Frankfurt (SMF 847, formerly NMW) (F. Krupp, pers. comm., 1985). The catalogue in Vienna listed six fish in spirits and one fish stuffed.

Jouladeh-Roudbar *et al*. (2020) suggested it could be a hybrid between *Alburnus* and *Squalius* species based on morphological features and its rarity. Molecular work is needed to clarify this suggestion.



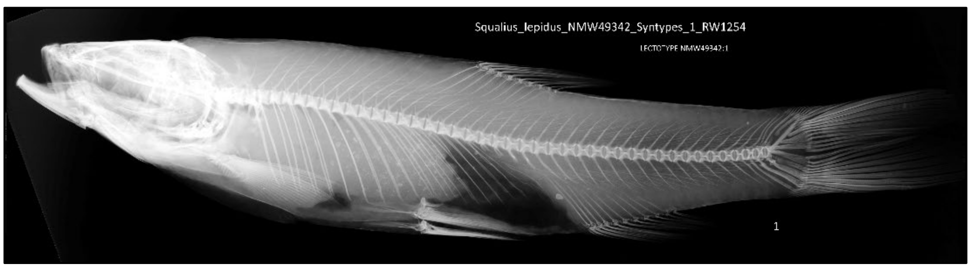
Squalius lepidus,
body and cross-section, lateral line scale, flank scale from between the dorsal fin and lateral line, and detail of flank scale, Naturhistorisches Museum, Wien, after J. J. Heckel.

Squalius lepidus, lectotype, NMW 49342, Naturhistorisches Museum Wien.



Squalius lepidus, lectotype, NMW 49342, Naturhistorisches Museum Wien.

Squalius lepidus, paralectotype, NMW 49342, Naturhistorisches Museum Wien.



Squalius lepidus, paralectotype, NMW 49342, Naturhistorisches Museum Wien.

Squalius lepidus, paralectotypes, NMW 49343, Naturhistorisches Museum Wien.

Squalius lepidus, paralectotypes, NMW 49343, Naturhistorisches Museum Wien.

Key characters. This species is distinguished by the elongate and pointed head with a projecting lower jaw, an adaptation for piscivory which develops early and is not evident in other *Squalius* even when these feed on fish as adults.

Morphology. The body is compressed and moderately deep. The predorsal profile is slightly to moderately convex. A nuchal hump may develop. The caudal peduncle is compressed and moderately to quite deep. The projecting lower jaw fits into a notch in the upper jaw. The mouth is oblique and extends back level with the nostril or the anterior eye margin. The dorsal fin margin is rounded and the fin origin is slightly posterior to the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the anterior or mid-anal fin. The caudal fin is moderately to shallowly forked with rounded lobes. The anal fin margin is straight and the fin does not reach back to the caudal fin base. The pelvic fin is rounded and does not reach back to the anal fin origin. The pectoral fin is rounded and does not reach back to the pelvic fin origin.

Dorsal fin unbranched rays 3-4, branched rays 7-10, usually 8 (Krupp, 1985c; Khaefi *et al.*, 2016) or 9 (Bogutskaya, 1994) (8 in four syntypes, 9 in one), anal fin unbranched rays 3, branched rays 8-11, usually 9 (9 in three syntypes, 10 in two), pectoral fin branched rays 14-18,

and pelvic fin branched rays 7-8, usually 8. Lateral line scales 42-55. A pelvic axillary scale is present. The scale is squarish with a rounded posterior margin, gently rounded dorsal and ventral margins, and a posterior margin with a rounded central part flanked by dorsal and ventral indentations and strong but rounded dorsal and ventral corners. The focus is almost central, slightly subcentral anterior. Circuli are fine and numerous. Scales have few to many radii on the anterior and posterior fields. Total gill rakers number 7-13, reaching the one below when appressed (near junction of upper and lower arches) and sometimes curled. Pharyngeal teeth are 2,5-5,2 or 2,5-4,2, strongly hooked and serrated. Total vertebrae number 42-46. The lectotype and paralectotype, NMW 49342, have 45 total vertebrae and the paralectotypes, NMW 49343, have 44 and 45 total vertebrae.

Sexual dimorphism. Unknown.

Colour. The back and upper flank are brown to bluish-brown or blackish, the flanks generally silvery, and the belly silvery-yellow. The upper flank, head and fins may be sprinkled with black spots. Flank scales have a spot at their base. All fins can be pale with rays pigmented, the caudal fin being overall darkest. Fins are reddish in some fish, with the pectoral and anal fins the brightest. The dorsal fin may have a black margin. The caudal fin is blue-grey or reddish and its margin is yellowish to blackish.

Size. Reaches 54.2 cm (Karabatak, 1997).

Distribution. This species is found in the Quwayq and Tigris-Euphrates basins. Records from the Tigris River basin in Iran are the Armand, Bazoft, Beheshtabad, Beshar, Boen, Chamesk, Chamzarivar, Dez, Dinorab, Dinvar, Gamasiab, Gaveh, Jarrahi, Karkheh, Karun, Kashkan, Khersan, Little Zab, Marakeh, Marun, Qareh Su, Qeshlaq, Simareh, Sirvan and Zemkan rivers, Lake Zaribar in Kordestan, the Haramabad Wetland in Hamadan, and the Qeshlaq Dam in Kordestan (Wossughi, 1978; Abdoli, 2000; Abbasi *et al*., 2009; Bahrami Kamangar *et al*., 2012a; Khaefi *et al*., 2016; Taghiyan *et al*., 2016; Pirali Khirabadi *et al*., 2017; Fatemi *et al*., 2019; Jouladeh-Roudbar *et al*., 2020; K. Abbasi photograph, see above). Also recorded from Mendeli on the Iran-Iraq border (Berg, 1949). Abdoli (2000) recorded this species from the Qom, Shur and Zayandeh rivers probably in error. Soofiani *et al*. (2011) recorded this species from the Dimeh Spring in the Zayandeh River - their largest specimen was 16.3 cm (*cf*. maximum size above) and identification needs verification. Also recorded from the headwaters of the Karun River as *Squalius cf. lepidus* (Zamaniannejad *et al*., 2015). A record from a canal near Gaz a few miles from Esfahan is also probably an error (Keyserling, 1861).

Kohgiluyeh and Bowyer Ahmad, Khersan River near Cheshmeh Nesai-ye Banestan
(river in Kohkiluyeh and Boyer-Ahmad…. in Farsi, CC BY 3.0, Seyed Mahmoud Javadi).

Zoogeography. Durand *et al*. (2000) using cytochrome *b* suggested that this species is fully introgressed with mtDNA of *Leuciscus cephalus* (= *S. cephalus* and presumably what is now recognised as *S*. *berak*) and so question the taxonomic validity of this species. Morphological data contradicts this conclusion. Durand *et al*. (2000) concluded that their data did indicate that "*L*. *lepidus* and *L*. *cephalus* might have had different dispersion histories over the same geographical range" and that "*L*. *lepidus* introgression by the chub (*L*. *cephalus*) is ancient, explaining the complete sorting of the *lepidus* lineage". However, Özuluğ and Freyhof (2011) speculated that this taxon is not the sister species of all other chubs in the Euro-Asiatic lineage but just easier to recognise. Khaefi *et al*. (2016) noted occasional hybridisation with *S*. *berak* which might lead to false identifications.

Habitat. This species is found in rivers, lakes and dams. Özuluğ and Freyhof (2011) found it to be restricted to main rivers while other, related species are found in tributaries. Khaefi *et al*. (2016) found it to be widespread in larger rivers and streams in lowland habitats. It occurred syntopically with *S*. *berak* in the Tabon River of the Little Zab River basin of Iraqi Kurdistan

Age and growth. Soofiani *et al*. (2011) for their 415 Zayandeh River fish (see identity comment above) found maximum age was 4^+ years, male:female sex ratio was 1:3, and von Bertalanffy growth parameters were k = 0.162, $L\infty$ = 232 mm, t_0 = -0.427 years for females and k = 0.136, $L\infty$ = 217 mm, t_0 = -0.847 years for males. The length-weight relationship was $W = 0.00005L^{2.827}$ for males and $W = 0.00005L^{2.855}$ for females, indicating negative allometric growth for both sexes. Hasankhani *et al*. (2014) found a *b* value of 2.78 for 62 fish, 4.3-15.4 cm total length, from the Sirvan River.

Çolak (1983) studied the age of this species in the Keban Dam, Turkey and found a maximum age of 8 years, that females grew faster and were longer than males, and growth was rapid until 5 years of age when it fell by almost half in each succeeding year. von Bertalanffy formulae, sexes combined, for two years were $L_t = 87.92 (1-e^{-0.112(t+1.464)})$ and $L_t = 65.64 (1-e^{-0.214(t+0.878)})$.

Food. Plant remains and fish scales have been found in gut contents. Fish appeared to be the main diet item even in young from about 10 cm in length (Bogutskaya, 1994) although Al-Rudainy (2008) cited fish fry and aquatic insects for Iraqi fish, presumably smaller ones.

Reproduction. Soofiani *et al*. (2011) for their Zayandeh River fish (identity uncertain) found minimum, maximum and mean fecundity to be 1,161, 12,953 and 4,279 eggs and relative fecundity was 148.4 eggs/g body weight. Gonadosomatic values indicated spawning in May-June.

Ünlü (2006) gave age at first maturity as 2-3 years in the Turkish Tigris River with spawning over sand, stone and gravel. Al-Rudainy (2008) cited sexual maturity at 3-4 years, 30 cm length and 3 kg weight in Iraq with spawning in March and April with eggs deposited in shallow water on gravel beds.

Parasites and predators. Williams *et al*. (1980) reported the digenean helminth *Allocreadium isoporum* from this species in the Zayandeh River at Esfahan but the fish species was most probably misidentified. Barzegar *et al*. (2008) recorded the digenean eye parasite *Diplostomum spathaceum* from this fish.

Economic importance. None.

Experimental studies. None.

Conservation. Listed as of Least Concern by the IUCN (downloaded 25 February 2019).

Sources. Some counts were taken from Bogutskaya (1994).

Type material:- *Squalius lepidus* (NMW 49342, NMW 49343 and NMW 49344).

Iranian material:- None.

Comparative material:- NMW 91149, 11, 69.6-115.9 mm standard length, Syria, Euphrates River at Jarabulus (36º49'N, 38º01'E); NMW 91620, 2, 91.6-95.6 mm standard length, Syria, Euphrates River at Jarabulus (36º49'N, 38º01'E); NMW 94441, 1, 175.7 mm standard length, Turkey, Palu, Murat River (38º42'N, 39º57'E).

Squalius namak

Khaefi, Esmaeili, Sayyadzadeh, Geiger and Freyhof, 2016

Squalius namak, ZM-CBSU G1001, paratype, 189.0 mm standard length, Markazi, Bolagh Spring, Hamid Reza Esmaeili.

Common names. Mahi sefid (= white fish - in central Iran), mahi sefid-e Namak (= Namak white fish), aroos or arus mahi Namak (= Namak bride fish).

[Namak Lake Chub].

Systematics. The holotype is under ZM-CBSU (Zoological Museum of Shiraz University, Collection of Biology Department, Shiraz) G121, 136 mm standard length, Iran, Markazi Province, spring Bolagh (Cheshmeh Bolagh) at Shazand, east of Anjirak, 34°00'38"N 49°50'51"E. Paratypes are from Markazi Province, ZM-CBSU G1001, 2, 155-189 mm standard length, ZM-CBSU G111, 10, 170-202 mm standard length, ZM-CBSU E769, 28, 57-188 mm standard length, ZM-CBSU G433, 5, 144-168 mm standard length and FSJF (Fischsammlung J. Freyhof, Berlin) 3521, 5, 105-146 mm SL, all same data as the holotype, and ZM-CBSU D871, 22, 37-110 mm standard length and FSJF 3522, 5, 57-122 mm standard length, Poledoab River at Shazand, 34°02'36"N 49°21'09"E. The species is named for the Namak Lake basin.

Mouludi-Saleh and Keivany (2018a) compared the three chub species from the Caspian Sea and Lake Urmia, Namak Lake and Tigris River basins based on 709 specimens and using 14 meristic and 19 morphometric characters. Significant differences in 11 meristic and 15 morphometric characters were found, the major differences being related to the position of the pectoral fin and head and body depth, but in general the populations highly overlapped.

Mouludi Saleh *et al*. (2017) examined fish from three rivers (Ginercheh, Jaj and Qom) in the Namak Lake basin and found significant differences in morphometry (such as head and body depths, anal fin position, caudal fin length and width) attributed to variation in water flow and level of feeding. Mouludi-Saleh and Keivany (2018c) examined fish morphometrically from the Khaznagh and Qareh Chay rivers and found the latter had a greater body depth and smaller head length and the former had a more inferior mouth, a longer snout and a shallower caudal peduncle. The inferior mouth may indicate bottom feeding and the shallower body a faster water habitat. Mouludi Saleh *et al*. (2018) compared the biometry of fish from Ghinercheh, Jaj, Khaznagh, Qareh Chay and Qom rivers using 14 meristic and 19 distance characters. The Khaznagh, Qareh Chay and Qom populations were separable morphometrically but meristic characters overlapped. Mouludi-Saleh and Eagderi (2021) compared this species with *S. turcicus* morphometrically and found the latter has a deeper body, longer caudal peduncle and a ventral snout position.

Key characters. This species is distinguished by having a wide and thick symphysial knob on the lower jaw, the upper lip clearly projecting beyond the lower lip, a deep and blunt head, a convex posterior anal fin margin, a bold, dark-grey or brown, roundish or crescent-shaped blotch at the posterior tip of each flank scale, orange caudal, anal and pelvic fin rays in life, distribution in the Dasht-e Kavir and Namak Lake basins, and mtDNA COI barcode data.

Morphology. The body is elongated, compressed and moderately deep. It is deepest in front of the dorsal fin between the end of the pectoral fin and the origin of the pelvic fin. The predorsal profile is slightly convex and a slight to well-developed nuchal hump is present. The upper head profile is concave or straight and the interorbital area is concave. The caudal peduncle is compressed and deep. The belly between the posterior pelvic fin bases and the anus is compressed. The snout is rounded to pointed. The rear margin of the eye is in the anterior half of the head. The mouth is oblique and terminal or subterminal or the lower lip may project slightly. The mouth extends back level with the anterior eye margin. The upper lip is thick at its mid-point. The uppermost point of the mouth cleft is between the level of the lower margin of the pupil and the lower margin of the eye. The lower jaw-quadrate junction is at about a vertical through the anterior margin of the eye. The lower jaw has a very wide and thick symphysial knob. The dorsal fin origin is well behind the level of the pelvic fin origin. The depressed dorsal fin reaches back level with the anterior anal fin. The dorsal fin margin is rounded to straight. The caudal fin is shallowly forked with rounded lobes. The anal fin margin is straight to rounded and

does not reach back to the caudal fin base. The pelvic fin is rounded and does not reach back to the anal fin origin. The pectoral fin is rounded and does not reach back to the pelvic fin origin.

The following counts are from Khaefi *et al*. (2016):- dorsal fin unbranched rays 3-4, mode 3, branched rays 7-10, mode 8-9 (in text; 7-9, mode 8 in table), anal fin unbranched rays 3-4, mode 3, branched rays 7-10, mode 8 (in text; 6-9, mode 8 in table), pectoral fin branched rays 15-18, usually 16-17, pelvic fin branched rays 9-11, mode 9. Lateral line scales 39-43 (in text; 40-45 total in table presumably including scales on caudal peduncle; Jouladeh-Roudbar *et al*. (2020) gave 39-46), scales between dorsal fin and lateral line 6-8, mode 7 (in text; 7-9, mode 8 in table), scales between pelvic fin and lateral line 3-4, mode 3 (in text; 4-5, mode 4 in table), scales around caudal peduncle 14-18, mode 16, and predorsal scales 19-24 (in text; 18-23 in table). A pelvic fin axillary scale is well-developed. Scale shape is squarish. Scales have a shallowly rounded posterior margin, gently rounded dorsal and ventral margins, and an anterior margin with a central protrusion with an indentation above and below. The anterior scale corners are abrupt but rounded. There are numerous fine circuli, a subcentral and slightly anterior focus, and few anterior and posterior radii. Total gill rakers number 9-12, mode 10. Pharyngeal teeth number 2,5-5,2, presumably with variants as seen under *S. turcicus*, and teeth are hooked at the tip and strongly serrated below it. Total vertebrae number 40-42 (Jouladeh-Roudbar *et al*., 2020).

Meristic values are:- dorsal fin branched rays 7(2) or 8(4), anal fin branched rays 7(1), 8(28) or 9(18), pectoral fin branched rays 15(2), 16(11), 17(30) or 18(4), pelvic fin branched rays 6(1), 7(-), 8(42) or 9(3), lateral line scales 41(13), 42(19), 43(11), 44(3), 45(-) or 46(1), total gill rakers 7(1), 8(3), 9(25) or 10(17), and total vertebrae 40(5), 41(13) or 42(12).

Sexual dimorphism. A specimen 97.2 mm standard length (CMNFI 2008-0228) had small tubercles closely spaced on the top and sides of the head, one to two rows on the unbranched pectoral fin ray and weakly on the branched rays, but this was a small fish where tuberculation was probably incompletely developed.

Colour. Khaefi *et al*. (2016) described live fish as having the head and body silvery brown, darker on the back, and the belly white. A faint black bar runs from the uppermost part of the gill opening to the pectoral fin base. Each flank scale margin has dark brown or black pigments forming a reticulate pattern. Scale pockets are poorly pigmented above the lateral line, with a bold, brown or black, crescent-shaped, vertically elongated or roundish anterior scale mark on scales below the lateral line. Free margins of scales above the lateral line are pale brown or grey, each with a bold, brown or black, crescent-shaped, vertically elongated or roundish blotch on the posterior tip. The pectoral, pelvic, anal and caudal fin rays are orange, the caudal fin rays with black pigments. Dorsal fin membranes are hyaline with dark-grey rays. Preserved fish have a pale brown head and body, darker on the back. Dorsal and caudal fins have blackish rays and hyaline membranes. The pectoral, pelvic and anal fins have whitish rays and yellowish membranes. The peritoneum is black.

Size. Attains 18.9 cm standard length (Khaefi *et al*., 2016).

Distribution. This species is found in the Dasht-e Kavir and Namak Lake basins. In the Dasht-e Kavir basin in the Hableh and Nam rivers; and in the Namak Lake basin in the Ab Chay, Abhar, Abshineh-Simineh, Alichay, Bahador Beyg, Bar, Damagh-Tasranmix, Fordaghan, Ghinercheh, Jaj, Kaleh, Karaj, Khar, Khaznagh, Khenejin, Khomeigan, Mazlaghan (= Mazdaqan), Pol-e Doab, Qareh Chay, Qom, Ravan, Saleh Abad, Sharra, Shur, Siah and Suzan rivers, the Bolagh, Emarat and Eskan springs in the Pol-e Doab River drainage, and the Emamzadeh Abdollah Spring in the Qom River drainage (Touraji and Vosoughi, 2006; Abbasi, 2009; Mirzaei *et al*., 2010; Khaefi *et al*., 2016; Mouludi Saleh *et al*., 2017, 2018; Mouludi-Saleh

and Keivany, 2018b, 2018c; Eagderi *et al*., 2020).

Zoogeography. See above under the genus.

Habitat. This species is found in rivers and springs. Collection data included a temperature range of 17.8-26ºC, pH 6.0-6.5, conductivity 1.3-3.7 mS, river width 0.5-12 m, slow to fast current, depth 70-100 cm, mud, sand, gravel or pebble bottoms, encrusting vegetation, and a grassy shore.

Age and growth. Mouludi-Saleh and Keivany (2018b) examined 132 fish, 2.4-15.1 cm total length, from the Ghare-Chi (= Qareh Chay), Ghinercheh (*sic*), Jaj, Khaznagh and Qom rivers of the Namak Lake basin and found a *b* value of 3.25. Eagderi *et al*. (2020) examined 49 fish, 8.21-16.6 cm total length, from the Ghareh-Chai (= Qareh Chay), Mazlaghan-Chay (= Mazdaqan Chay) and Nam rivers and found a *b* value of 3.09, positively allometric.

Food. Unknown.

Reproduction. Unknown.

Parasites and predators. None reported.

Economic importance. None.

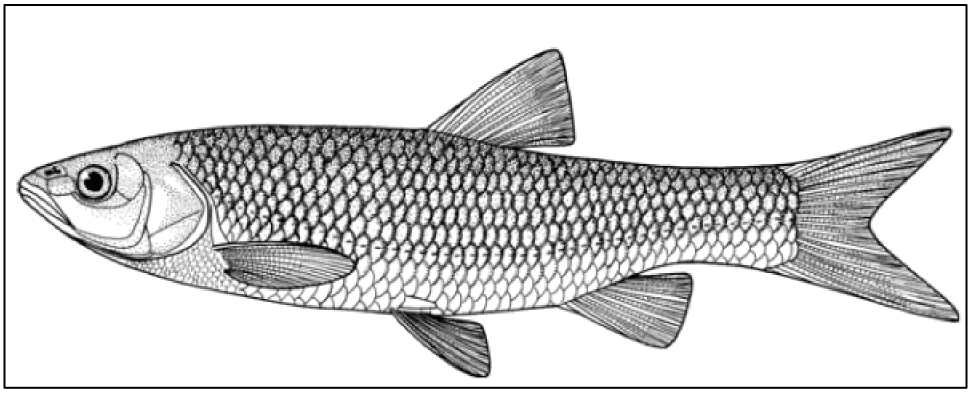
Experimental studies. None reported.

Conservation. This species is found in a basin with large population centres and agriculture and so would be under threats similar to related species elsewhere and to other species in this basin. Jouladeh-Roudbar *et al*. (2020) listed it as of Least Concern because populations are widespread and there are no major threats.

Sources. Khaefi *et al*. (2016).

Iranian material:- CMNFI 1979-0253, 33, 46.4-100.4 mm standard length, Qom, river in Qareh Chay drainage (34º52'N, 50º49'E); CMNFI 1979-0255, 2, 90.7-90.8 mm standard length, Markazi, Bar River drainage 2 km west of Shahabiyeh (33º51'30"N, 50º23'E); CMNFI 1979-0462, 12, 50.7-104.5 mm standard length, Markazi, Mazdaqan River (35º06'30"N, 49º40'30"E); CMNFI 1979-0465, 13, 54.7-70.5 mm standard length, Markazi, Qom River (34º18'30"N, 50º32'E); CMNFI 1980-0156, 1, 54.2 mm standard length, Alborz, Karaj River below village (35º47'N, 50º58'E); CMNFI 1993-0154, 1, 94.8 mm standard length, Markazi, Sharra River near Far (34º03'N, 49º20'E); CMNFI 1993-0158, 1, 88.5 mm standard length, Markazi, Sharra River at Taht-e Mahall (34º01'N, 49º22'E); CMNFI 2007-0074, 17, 24.3-125.5 mm standard length, Markazi, Qareh Chay 32 km west of Arak (34°03´N, 49°21´E); CMNFI 2007-0077, 1, 49.0 mm standard length, Markazi, Qom River (ca. 34º18'N, 50º32'E); CMNFI 2007-0078, 2, 90.4-108.6 mm standard length, Markazi, Qom River (ca. 34º18'N, ca. 50º32'E): CMNFI 2007-0120, 25, 31.1-47.4 mm standard length, Hamadan, Ab Chay near Hamadan (ca. 34º49'N, ca. 48º29'E); CMNFI 2007-0122, 1, 46.7 mm standard length, Qazvin, Khar River basin south of Takestan (ca. 35º56'N, ca. 49º30'E); CMNFI 2008-0152, 2, 89.2-117.6 mm standard length, Namak Lake basin (no other locality data); CMNFI 2008-0228, 2, 85.9-97.2 mm standard length, Markazi, Qom River (no other locality data).

Squalius turcicus
De Filippi, 1865



Squalius turcicus
Susan Laurie-Bourque @ Canadian Museum of Nature.

Squalius turcicus, Gilan, Lakan River, Anzali Talab basin, 0.35 kg, caught on blood worm and released, Sarang Nouripanah.

Squalius turcicus, Gilan, Lakan River, Anzali Talab basin, female, 40 cm, 0.9 kg, Sarang Nouripanah.

Squalius turcicus, Zanjan, Golabar Reservoir, November 2011, Keyvan Abbasi.

Common names. Mahi sefid (= white fish), kuli (= general term for any small fish), Sefid roodkhaneyi (= Sefid River fish), aroos, arus or 'rus mahi (= bride fish, Y. Keivany, pers. comm., 25 September 2018).

[Enlibas or gafgaz enlibasi, nour enlibasi for natio *kaznakovi*, all in Azerbaijan; tepug in Armenia; Kura tatlı su kefali in Turkish (Kaya *et al*., 2020); Kavkazskii golavl' or Caucasian chub in Russian; Transcaucasian chub].

Systematics. Iranian populations were usually recognised as *Leuciscus cephalus orientalis* (Nordmann, 1840) in past literature. The nominal Iranian subspecies, *L. cephalus orientalis*, differs from the European subspecies, *L. c. cephalus*, by having a more elongate body, a dark stripe behind the operculum and on average fewer scales and anal fin branched rays according to Berg (1948-1949, 1949). Bianco and Banarescu (1982) pointed out that there had been no critical revision of the *cephalus* subspecies and that differences were slight. Recognition of subspecies is disputable according to Reshetnikov *et al*. (1997). However, *S. orientalis* was recognised as a species by Turan *et al*. (2009), Bogutskaya and Zupančič (2010) and Esmaeili *et al*. (2014), and others, and was used as the name for the fishes found in the Caspian Sea basin of Iran. *Cyprinus cephalus* Linnaeus, 1758 was originally described from northern Europe. *Leuciscus orientalis* Nordmann, 1840 was originally described from Abkhazia, Georgia.

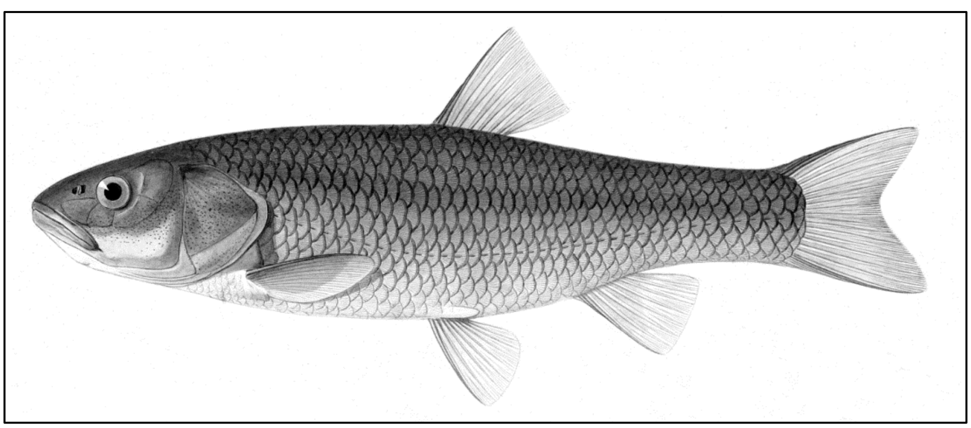
Doadrio and Carmona (2006), Özuluğ and Freyhof (2011), Turan *et al*. (2013, 2017), Keivany *et al*. (2016), Khaefi *et al*. (2016), Abbasi *et al*. (2017), Eagderi and Moradi (2017), Esmaeili *et al*. (2017) and Mouludi-Saleh *et al*. (2018) considered fish in the Caspian Sea and Lake Urmia basins of Iran to be *S. turcicus*. However, Çiçek and Sungur Birekcikligil (2016) did not record *S. turcicus* from localities near Iran in their collections in the Turkish Kura-Aras River basin. Fish from the Lake Urmia basin are distinct from Kura River (and presumably Caspian Sea basin fish here referred to *S. turcicus*) and are more closely related to Tigris River basin fish according to N. Bogutskaya (*in litt*., 9 November 2015). Recent molecular studies cited above disagree. It is distinguished from *S. orientalis* (Nordmann, 1840) of the Black Sea basin by the absence of orange pigments on the anal fin rays of live specimens having a few brownish pigments, narrow scale pockets almost entirely covered by the preceding scales rather than broad scale pockets, a black bar behind the opercle absent or very slightly distinct, and the absence of a hump at the nape especially in fish larger than 20.0 cm standard length (Turan *et al*., 2013). However, colour photographs of Iranian fish show orange anal fins and a black bar behind the opercle indicating that further work is needed on the distinction of these fishes although the name *turcicus* may still apply to Caspian and Urmia fish.

Squalius turcicus De Filippi, 1865 described from "Dell' Arasse presso Erzerum" (Aras River near Erzerum in Turkey) and *Squalius agdamicus* Kamensky, 1901 from near Agdam in

the Kura River basin were formerly synonyms of *S. cephalus* but are now recognised as distinct species (*Catalog of Fishes*, downloaded 23 May 2018). The recognition of the above taxa as distinct restricts the distribution of *S. cephalus* and *S. orientalis* to areas outside Iran

Several natio and varieties within what was *Leuciscus* or *Squalius cephalus* have been described from Iran or contiguous drainages and are listed as follows. They have not been used in the literature, are not available being infrasubspecific, but the names may reoccur. *Leuciscus cephalus orientalis* natio *kaznakovi* Berg, 1912 was described from Lake Nour near Vandam, Nukha District, Azerbaijan (in the Tur'yan-chai basin of the Kura River basin but not connected to it). *Squalius turcicus* var. *platycephala* Kamensky, 1897 was described from Lake Taparavani (= Lake Paravani at 41°26'N, 43°48'E) and the Kyrchbulach River in the upper Kura River basin, Georgia. *Leuciscus cephalus orientalis* natio *aralychensis* Barach, 1934 was described in Latin from "Turcia, Aralych. fl. Kara-su", and in Russian "Reka Kara-su u vblizi Aralykha podnoshchiya Ararata" (= Kara-su River at the foot of Ararat in the vicinity of Aralykha). *Leuciscus cephalus orientalis* natio *zangicus* Barach, 1934 was described in Russian from "R. Zanga v Armenii" (i.e., at Erivan). *Leuciscus cephalus orientalis* natio *ardebilicus* Barach, 1934 was described in Latin from "Ardebil, fl. Balyk-tchai in systemate fl. Arax. inf." and in Russian "R. Balyk-chaya, vblizi Ardebilya v Persii" (i.e., Balyk River or Balyk-chai) in the upper Aras River basin of Iran near Ardabil.

There are no extant types of *S. orientalis*. The syntypes of *Cyprinus cephalus* are in the Naturhistoriska Riksmuseet, Stockholm under NRM 51 (1 fish) and in the Zoologiska Museet, Uppsala Universitet, Uppsala under ZMUU Linnaeus Collection 213 (1) (Eschmeyer *et al*., 1996; *Catalog of Fishes*, downloaded 15 May 2018). Three syntypes of *Squalius orientalis* Heckel, 1847, 111-146 mm standard length from Aleppo are in the Naturhistorisches Museum Wien under NMW 49438 (Krupp, 1985c). Two more fish from Aleppo are under NMW 49440 and measure 130.0-168.3 mm standard length and may be syntypes. Types of *Squalius agdamicus* and *S. turcicus* have not been located. Natio *ardebilicus* syntypes are in the Georgian State Museum, Zoological Section, Tbilisi under ZMT 136h, natio *aralychensis* syntypes are under ZMT 22-11 (10), natio *kaznakovi* syntypes are in the Zoological Institute, St. Petersburg under ZISP 12089 (5), syntypes of natio *zangicus* are in the Natural History Museum, Armenia (17) and no types of natio *platycephala* were found in the Zoological Institute, St. Petersburg (Eschmeyer *et al*., 1996; *Catalog of Fishes* (downloaded 15 November 2015)).



Leuciscus cephalus orientalis natio *kaznakovi*, syntype, ca. 25.6 cm total length, ZISP 12089, Azerbaijan, lake near Vandam (= Lake Nour), Kura River basin, after Berg (1948-1949).

Özuluğ and Freyhof (2011) noted, following Berg (1948-1949), that the western lineage of *Squalius cephalus* has modally 8 anal fin branched rays while the eastern lineage has 9 and gave their own counts to confirm this. Their material did not extend east to Iran where counts given below show a mode of 8 (57.7%) with high counts of 9 (42.3%) excluding three counts of 7 branched rays. Anal ray counts do not appear to be a useful character.

Dadashpour Ahangari *et al*. (2010) compared 36 fish from the Gamasiab River (presumably *S. berak*) in the Tigris River basin and 31 from the Talar River in the Caspian Sea basin, finding significant differences in characters but no population distinction using principal components analysis. Gorjian Arabi *et al*. (2011) surveyed morphological diversity of 123 male and 115 female fish from the Tuji head branch of the Talar River, Mazandaran for eight meristic and 26 morphometric characters, finding no significant differences between sexes. Babazadeh and Vatandoust (2013) examined 167 fish from the Shahid Rajaei Dam and the Tajan River below it for 27 morphometric and nine meristic characters but found populations were not separable despite a low level of overlap. However, Babazadeh and Shapoori (2017) compared the same localities and characters and reported significant differences. Alizadeh *et al*. (2015) examined morphometric and meristic characters of fish from the Dogh, Sefid and Siah rivers in the southern Caspian Sea basin finding sexual dimorphism in all populations (pupil diameter, postdorsal distance, length of anal fin base, interorbital distance and head width), and all populations separated significantly with such characters as caudal peduncle width, pectoral fin base, eye diameter, interorbital distance, pupil diameter and anal fin base length. Mouludi Saleh *et al*. (2018) examined 264 fish from the Babol, Haraz, Neka, Noor and Tajan rivers using 13 landmarks finding Babol and Haraz populations grouped apart from the others, the major differences in body shape being related to head and body depth and position of the anal and pectoral fins. Mouludi Saleh *et al*. (2018) digitised populations from the Aras, Atrak, Ghar Chai, Kheyr, Sefid and Tajan rivers using 14 landmarks and found significant morphometric differences between them. Mouludi Saleh and Keivany (2019) compared fish morphometrically from the Chalak, Divandarreh, Kasma, Noor, Palangab, Qezel Owzan, Sefid, Shafa, Talvar, Tonekabon, Zalkie and Zarin rivers in the southwest Caspian Sea and found significant differences between populations related to head and body depth and the position of the anal, dorsal and pectoral fins. These differences were adaptations to various habitats. Mouludi-Saleh *et al*. (2020) examined 102 specimens from the Aras, Atrak, Ghareh-Su (= Qareh Su), Kheyr, Sefid and Tajan rivers using 14 homologous landmarks. Significant differences were found in body shape for the six populations in particular related to the snout, base of the dorsal and anal fins, body depth and pectoral fin position. The Kheyr population stood alone and showed a longer snout and caudal peduncle. The Tajan and Atrak populations had a higher and lower body depth. The Aras and Atrak populations possessed a shorter anal fin base and a shallower body depth. Both Aras and Atrak specimens had a shorter dorsal fin base. The Qareh Su population had a deeper caudal peduncle. These differences were attributed to phenotypic plasticity to the environment. A deeper body shape is advantageous in rapid turning and maneuvering in tight quarters, such as area with aquatic plants, as seen in the Tajan River. A lower body depth with a fusiform body shape, as seen in the Aras and Atrak populations, could decrease drag in the current, hence reducing energy consumption to maintain position and also this could be useful for constantly moving and searching out prey.

Key characters. This species is distinguished from its relatives by having modally 8 dorsal fin branched rays, the knob on the lower jaw symphysis is small, the posterior tip of flank scales lacks a bold blotch, the mouth is terminal (or slightly to markedly subterminal), the tip of

the upper lip is level with the tip of the lower lip, caudal, anal and pelvic fin rays are orange in life, and distribution is in the Caspian Sea and Lake Urmia basins.

Morphology. The body is compressed and moderately deep. The dorsal profile of the body is straight to arched while the ventral profile is convex. The caudal peduncle is compressed and moderately deep. The snout is pointed to slightly rounded and, in males, the chin is indistinct. The eye is well into the anterior half of the head. The mouth is oblique and extends back level with the anterior eye margin. Lips are moderately thick, the upper lip thickest at the middle. The dorsal fin margin is straight or slightly convex. The dorsal fin origin lies posterior to a level with pelvic fin origin (but see natio *kaznakovi* drawing above). The caudal fin is shallowly forked with rounded tips. The anal fin margin is convex to straight and the fin does not reach back to the caudal fin base. The pelvic fin is rounded and does not extend back to the anal fin. The pectoral fin is rounded and does not extend back to the pelvic fin. Fin rays are thin (Turan *et al*., 2017).

Dorsal fin unbranched rays 2-3, usually 3, branched rays 6-10, usually 8, anal fin unbranched rays 3, branched rays 7-10, usually 8 or 9, pectoral fin branched rays 14-19, and pelvic fin branched rays 6-9, usually 8. Lateral line scales 38-48. There is a prominent pelvic axillary scale. Scale shape is squarish. The anterior scale margin is wavy, sometimes irregular and in others with a small central protuberance and indentations above and below. Scales have few to moderate numbers of radii on the anterior and posterior fields. The focus is central to subcentral anterior and circuli are fine. On the posterior field, circuli break up into tubercles and are coarser than on other fields. Total gill rakers number 7-12, and are short, touching the adjacent raker when appressed. Pharyngeal teeth are 2,5-5,2, with variants 2,5-4,2, 2,4-4,2, 2,5-5,1, 1,5-5,2, 1,5-5,1, 2,5-5,3, 2,6-5,2, or even 1,5-5,1,2 and 1,2,5-5,2,2. Teeth are very narrow, strongly hooked at the tip and with strong rounded serrations below so that there is no obvious flat surface. The gut is an elongate s-shape. Total vertebrae number 40-46, usually 41-42. Total vertebrae number 47-49 according to Jouladeh-Roudbar *et al*. (2020) at variance with my counts. Chromosome number is 2n = 50 (Al-Sabti, 1986; Klinkhardt *et al*., 1995; Arai, 2011; Kiliç and Şişman, 2016 - for fish identified as *S. cephalus*). Jalali (2015) and Vatandoust *et al*. (2016) described the osteology of this species in the Caspian Sea and Lake Urmia basins.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(3), 8(103) or 9(1), anal fin branched rays 7(3), 8(60) or 9(44), pectoral fin branched rays 14(3), 15(13), 16(39), 17(46), 18(5) or 19(1), pelvic fin branched rays 6(1), 7(1), 8(100) or 9(5), lateral line scales 40(2), 41(20), 42(45), 43(30), 44(9), 45(-) or 46(1), total gill rakers 7(2), 8(14), 9(58), 10(31) or 11(2), and total vertebrae 40(6), 41(29), 42(45) or 43(6).

Khaefi *et al*. (2016) and Mouludi-Saleh *et al*. (2018) summarised meristic characters for fish from Caspian Sea Iranian rivers as follows: dorsal fin branched rays 6-10, mode 8, anal fin branched rays 7-10, mode 8, pectoral fin branched rays 14-17, pelvic fin branched rays 8-9 (in a table, 7-9 in the text of Mouludi-Saleh *et al*. (2018)), lateral line scales 41-47, scales above lateral line 7-10, mode 8, scales below lateral line 3-5, mode 4, predorsal scales 16-23 and scales around caudal peduncle 14-16 (in a table, 12-16 in the text of Mouludi-Saleh *et al*. (2018)). The population from the Divandarreh River was identified as a separate group based on cluster analysis (in the abstract, Kasma River in the text and a table) but generally meristic characters cannot separate populations although six major clusters were recognised. My counts agree with those of Turan *et al*. (2013) for fish from the Aras and Kura rivers in Turkey.

Sexual dimorphism. Abdurakhmanov (1962) reported that head length, eye diameter, caudal peduncle length, dorsal and anal fin heights, pectoral and pelvic fin lengths and lower

caudal fin lobe length are all greater in males while postorbital length, interorbital width, head depth and pectoral-pelvic fin distance are greater in females. See also above under **Systematics**.

Colour. Overall colour is silvery to grey. Scales of the lateral line and upper back have a strong dark pigmentation along the posterior margin and a distinct dark spot anteriorly but no bold blotch at the posterior scale tip. Scales may have some gold in their centre. The back is dark brown or reddish-brown to blue-grey and the belly and lower head are pearly-white to a silvery yellow. The operculum is a strong copper-yellow colour and the opercular opening is dark, nearly black. The iris is silvery and has very little gold, or is golden with a lot of dark grey pigment. There may be an upper spot of dark grey on the iris. The dorsal and anal fins are grey and may have some pink or orange. The dorsal fin is blackish distally. The pectoral fin has a little pale grey pigment and there may be a yellow or yellow-pink spot at its upper base with this colour extending onto the first 2-3 rays. The pelvic and anal fins are pink to red-pink or orange with somewhat colourless posterior margins, especially in spawning males. The caudal fin is dark or a pale pink to dirty reddish with some dark pigmentation to the posterior margin. The peritoneum is dark brown in preserved fish.

Size. Possibly as long as 85.0 cm although 45.0 cm is a more likely maximum (Berg, 1948-1949; Machacek (1983-2012), downloaded 27 July 2012) and a weight of 6-8 kg, possibly 10.0 kg (Machacek (1983-2012), downloaded 27 July 2012), although these figures included *S. cephalus*. Reaches 43.0 cm total length in the Madar Su of Golestan National Park (A. Abdoli, pers. comm., 1995). Reaches 39.2 cm and 870 g in Taham Dam in northern Iran (*Iranian Fisheries Research Organization Newsletter*, 54 & 55:4, 2008). Attains 39.0 cm fork length in Çıldır Lake, Aras River basin, Turkey (Yerli *et al*., 1999).

Distribution. This species is found in the Caspian Sea and Lake Urmia basins. Records for the Caspian Sea basin are the Ahar, Alamut, Aras, Atrak, Avachar, Azar, Babol, Balekhlu, Chalak, Chalus, Chapak, Chay, Cheshmeh Kileh, Divandarreh, Dogh, Garm, Gaveh, Ghar Chai, Ghorichay (= Quri Chay), Gorgan, Haraz, Harisak, Haviq, Kasma, Kelarud, Keselian (= Kaslian), Khair (= Kheyr), Kiarud, Lakan, Madar Su, Neka, Noor, Palangab, Pir Bazar, Polrud (= Pol-e Rud), Qareh Su, Qezel Owzan, Qonbad, Ramian, Rasteh, Sardab, Sefid, Shafa, Shah, Shalman, Shirabad, Shirud, Shur, Siah, Siah Darvishan, Tajan, Talar, Taleghan (= Taleqan), Talvar, Tilabad, Tonekabon, Tuji, Valam, Yasalegh, Zalkie, Zanjan, Zarin, Zarrin Gol, Zav and Zonuz rivers, Chay Almas Spring in Ardabil Province, the Anzali Wetland, the Alborz, Sattarkhan and Shahid Rajaei dams, the Golabar and Taham dams in Zanjan Province, and the Nazdik, Sefid and Zir dams on the Sefid River; and for the Lake Urmia basin the Aji (= Talkheh), Baranduz, Bitas, Chamalton, Hasanlu, Koter, Mahabad, Mardogh, Qader, Roseh, Saqqez, Serudan, Simineh and Zarrineh rivers, and in the Cheragveis, Hasanlu and Mahabad dams (Günther, 1899; Berg, 1949; Wossughi, 1978; Bianco and Banarescu, 1982; Holčík and Oláh, 1992; *Abzeeyan*, Tehran, 5(5):III, 1994; Abbasi *et al*., 1999, 2005, 2007, 2009, 2014; Roshan Tabari, 1997; Shamsi *et al*., 1997; Kiabi *et al*., 1999; Abdoli, 2000; Mirhasheminasab and Pazooki, 2003; Aghili *et al*., 2008; Abdoli and Naderi, 2009; Hajirostamloo, 2009; Piri *et al*., 2009; Mirzajani, 2010; Gorjian Arabi *et al*., 2011, 2012; Mirzajani *et al*., 2012; Babazadeh and Vatandoust, 2013; Rahmani *et al*., 2013; Abdoli *et al*., 2014; Gholizadeh *et al*., 2014; Hosseinifard *et al*., 2014; Moradi and Eagderi, 2014; Rekabi *et al*., 2014; Jafarzadeh *et al*., 2015; Khaefi *et al*., 2016; Taghiyan *et al*., 2016; Vatandoust *et al*., 2016; Babaei, 2017; Eagderi and Moradi, 2017; Taheri Mirghaed *et al*., 2017, 2018; Mouludi-Saleh and Keivany, 2018b; Mouludi Saleh *et al*., 2018, 2018, 2020; Fathi and Ahmadifard, 2019; Eagderi *et al*., 2020; Jouladeh-Roudbar *et al*., 2020; Mouludi-Saleh *et al*., 2020; Shahnazari *et al*., 2020; Aazami and Alavi

Yeganeh, 2021; Seyfi *et al*., 2021).

Zoogeography. Durand *et al*. (1999), working on the cytochrome *b* of European populations, found that a lineage from a Ponto-Caspian refugium recolonised the Baltic area in the Holocene after glaciation. Durand *et al*. (2000), again examining cytochrome *b*, considered that *S. cephalus* (presumably including *S. orientalis* and other taxa formerly called subspecies or synonyms) may have originated from Mesopotamia and, in the late Pliocene, used the large inland lake of Anatolia existing at that time for dispersion. Uplift of the Anatolian Plateau, climatic changes and river isolation was probably the main vicariant event leading to a quick radiation in these chubs.

Habitat. This species is found in rivers, streams, lakes, dams, lagoons and marshes. Collection data included a temperature range of 11.5-29ºC, pH 6.0, conductivity 0.75-1.95 mS, river width 2-100 m, still to fast current, depth 50-100 cm, muddy water, mud, clay, sand, gravel or pebble bottoms, encrusting, emergent and submergent (such as *Potamogeton*) vegetation, and a grassy or forested shore. In the Caspian Sea basin, it is found mainly in upstream waters according to Naderi Jolodar and Abdoli (2004).

Habitat of *Squalius turcicus*, Gilan, Lakan River, Anzali Talab basin, Sarang Nouripanah.

Habitat of *Squalius turcicus*, CMNFI 1979-0482, Golestan,
river between Minudasht and Dowlatabad, 6 July 1978, Brian W. Coad.

Age and growth. The weight class 150-450 g dominated in Taham Dam in Iran (*Iranian Fisheries Research Organization Newsletter*, 54 & 55:4, 2008). Ashja Ardalan *et al*. (2011) examined 441 fish from the Babol River and found the average total length was 165.6 mm, with an average maximum in May (190.6 mm) and an average minimum in October (137.5 mm), average fork length and weight for males was 139.72 mm and 43.18 g, these values for females being 152.88 mm and 57.32 g, fish reached age 4^+ with most in age group 2 and the minimum in age group 4^+. The gonadosomatic index for males was 1.47 and for females 2.95 and the hepatosomatic index was 0.73 for males and 1.08 for females. Biniaz *et al*. (2011) in contrast found 7 age groups in 251 fish above and below the Alborz Dam on the Babol River. Above the dam, the average of total length and body weight for males was 120.44 mm and 23.23 g, for females 148.33 mm and 39.91 g, and below the dam, for males was 117.08 mm and 22.15 g and for females 131.47 mm and 31.9 g, and the sex ratio of female:male, above and below the dam was 1:1 and 1:1.69, respectively. Gorjian Arabi *et al*. (2012) examined 298 fish from the Tuji tributary of the Talar River in Mazandaran finding fish from 0^+ to 4^+ years, positive allometric growth for males and females and negative isometric growth for immature fish, fastest growth in age groups 2^+ and 3^+ (average instantaneous growth rate 1.1, compared to 0.89 for 3^+ and 4^+ age groups), highest condition factor 1.58 for females and lowest 1.17 for immature fish, and an equal sex ratio. Alizadeh *et al*. (2014) compared 958 fish from Gilan, Golestan and Mazandaran and found a total length of 22-33 cm, weight 138.62-347.7 g, males age 0^+ to 5^+ and females age 0^+ to 6^+, von Bertalanffy parameters different between males and females in each area and between the same sexes of different areas, the largest L_∞ was in Gilan (38.97 cm for females), growth was positively allometric (except for males in Golestan), the highest condition factor was for males in early June, and females had the highest growth rate. Esmaeili *et al*. (2014) gave a *b* value for 16 fish from the Caspian Sea, 8.37-11.6 cm total length, as 3.17. Rekabi *et al*. (2014) found no significant differences between condition factors of 46 and 24 fish from the Siah and Tajan rivers (averages 1.39 and 0.49) and growth was isometric and positive allometric

respectively. Aazami *et al*. (2015b) gave a *b* value of 3.09 for 642 fish, 5.73-21.18 cm total length, from the Tajan River. Amouii *et al*. (2016) found females were between 1 and 5 years old in the Sefid River based on 150 females, 8.5-32.0 cm total length. Seifi *et al*. (2017a, 2017b) found 591 fish in the Shahid Rajaei Dam in Sari during four seasons in 2015-2016 had mean total length for males and females as 161.36 and 170.75 cm and mean body weight for males and females as 54.18 and 63.61 g, the length-weight relationship for males was 3.056W = 0.01L and for females was 3.0025W = 0.0113L, indicating isometric growth, and back calculations determined for all age groups 1 to 4 years old did not show a significant difference between methods. Mouludi-Saleh and Keivany (2018b) examined 542 fish, 2.0-18.1 cm total length, from the Babol, Chalak, Divandarreh, Haraz, Kasma, Neka, Noor, Palangab, Qezel Owzan, Sefid, Shafa, Tajan, Talvar, Tonekabon, Zalkie and Zarin rivers and found a *b* value of 3.37. Eagderi *et al*. (2020) examined 86 fish, 3.8-15.62 cm total length, from the Balekhlu, Kheyr, Sefid, Siah, Tajan and Talar rivers and found a *b* value of 3.17, positively allometric. Seyfi *et al*. (2021) studied the population dynamics of 591 fish identified as *Squalius cephalus* from the Shahid Rajaei Dam in Mazandaran sampled at three stations in four seasons. The most frequent catch was in autumn (303 fish) and the lowest catch was in winter (43 fish). Both sexes had age groups 0^+ to 5^+ with two-year-olds prevailing in both sexes. The male:female sex ratio was 1:1.06, not significantly different. Fish were 10.2 to 26.5 cm in length and 11.59 to 241.86 g in weight with females longer and heavier than males. The length-weight relationships were $W = 0.000001L^{3.05}$ for females, $W = 0.000009L^{3.01}$ for males and $W= 0.000001L^{3.01}$ for the population, all positively allometric. The von Bertalanffy growth equation for males was $L_t = 27.04(1-e^{-0.23(t+2.03)})$ and for females was $L_t = 31.4(1-e^{-0.22(t+1.31)})$. The condition factor was almost equal in both sexes but was significantly different in age groups from 0^+ to 3^+. Many dynamic parameters were better in the dam than in the river, 15 years after the dam was constructed.

Öztaş (1988, 1989), Öztaş and Solak (1988) and Türkmen *et al*. (1999) studied the chub in the Aras River of Turkey and found its condition factor to be higher in summer and autumn and to vary between age groups. Life span there was over 8 years (Ünlü and Balcı, 1993a, 1993b). In the Aras, females grew faster than males and there were more sexually mature females in the older age groups. Sexual maturity was attained at age 2-3 in males and ages 3-4 for females. Mean condition factor for Aras males was 1.326 and for females 1.333.

Food. Food items included mayfly and caddisfly larvae, other small organisms such as molluscs, and crayfishes, small fishes and frogs. Large fish fed mainly on other fish. Reputedly even fruit fallen in the water will be eaten. Trout eggs and fry were also eaten. Guts of Iranian specimens contained a wide variety of organisms including ants (presumably taken at the water surface), aquatic insects such as chironomids among others, crustaceans, filamentous algae, higher plant fragments, scales of cyprinids and the remains of a *Paracobitis malapterura*. Abdoli (2000) reported Ephemeroptera, Chironomidae and Trichoptera. In Taham Dam algae, higher plants, bivalves and insects were found (*Iranian Fisheries Research Organization Newsletter*, 54 & 55:4, 2008). Seyfi *et al*. (2021) in their Shahid Rajaei Dam study found relative gut length indicated a tendency to carnivorous feeding and the vacuity index showed males were relatively edacious and females were edacious or voracious. Based on the index of fullness in both sexes and different ages, feeding conditions were not appropriate.

Reproduction. Spawning in Iran appears to take place in spring judging from egg development. Around 40% of the fish in Taham Dam in Iran spawned in early June and around 30% did not spawn at all (*Iranian Fisheries Research Organization Newsletter*, 54 & 55:4, 2008). Ashja Ardalan *et al*. (2010) examined fish from the Babol River and found mean egg

diameter was 69.83 μm in May, mean absolute fecundity was 8,038, average gonadosomatic index was 1.47 for males and 2.95 for females, and condition factor was 1.12 for males and 1.17 for females. Spawning occurred once from mid-May to late June. Biniaz *et al*. (2011) found reproduction in fish above and below the Alborz Dam on the Babol River was similar. The female:male sex ratio was 1:1 and 1:1.69 above and below the dam, egg diameter was a mean of 0.94 mm and 0.75 mm respectively, absolute fecundity was a mean of 6,417 and 5,111 respectively, the gonadosomatic index was 2.52 for males and 4.66 for females above the dam and 3.7 and 4.09 below, the hepatosomatic index was 1.18 for males and 1.25 for females above the dam and 0.66 and 1.03 below. Ashja Ardalan *et al*. (2011) also examined fish from the Babol River and found batch spawning was from mid-May to late June. Amouii *et al*. (2016) found that the mean gonadosomatic index for Sefid River fish peaked between April and May. Seyfi *et al*. (2021) in their Shahid Rajaei Dam study found an absolute and relative fecundity of 4,478.2 eggs and 54.1 eggs/g and the average egg diameter was 0.86 mm.

Öztaş (1989) examined reproduction of this species in a stream tributary to the Aras River in Turkey. Spawning began at the end of May although most fish spawned in June. Water temperatures at this time were 12-18°C. Fecundity was up to 61,808 eggs and maximum egg diameter was 1.39 mm. Türkmen *et al*. (1999) found spawning between May and July in the Aras River proper with fecundity up to 17,187 eggs. In Azerbaijan, Abdurakhmanov (1962) gave spawning temperatures as 12-21°C, maximum fecundity as 118,000 eggs, and maximum egg diameter as 1.8 mm.

Parasites and predators. Ergens and Gusev (1965) reported the monogenean helminth *Dactylogyrus prostae* in this species from Bandar-e Shah (= Bandar-e Torkeman) on the Caspian Sea coast. The monogeneans *Diplozoon paradoxum* and *D. megan* were recorded from this species in the Tajan River, Mazandaran (*Iranian Fisheries Research and Training Organization Newsletter*, 6:7, 1994). Shamsi *et al*. (1997) and Moumeni *et al*. (2020) reported *Clinostomum complanatum*, a parasite causing laryngo-pharyngitis in humans, from this species in the Shirud. Masoumian and Pazooki (1998) surveyed myxosporeans in this species in Gilan and Mazandaran provinces, finding *Myxobolus minutus* and *M. muelleri*.

Mirhasheminasab and Pazooki (2003) listed *Ergasilus peregrinus*, *Tracheliastes polycolpus* and *Lernaea cyprinacea* from this species in Mahabad Dam, the latter being the most dangerous parasite. Jalali *et al*. (2005) summarised the occurrence of *Gyrodactylus* species in Iran and recorded *G*. sp. from fish in the Sefid River. Pazooki *et al*. (2005) recorded *Lamprolegna compacta*, *Ergasilus peregrinus* and *Lernaea cyprinacea* from this species in waterbodies of Zanjan Province. Miar *et al*. (2008) examined fish in Valasht Lake and the Chalus River, Mazandaran and found the protozoan *Chilodonella hexastica*. Barzegar and Jalali (2009) reviewed crustacean parasites in Iran and found *Ergasilus peregrinus*, *Ergasilus* sp., *Lamproglena compacta*, *Lernaea* sp., *Tracheliastes longicollis* and *Tracheliastes polycolpus* on this species. *Ligula intestinalis* was recorded from fish in Sattarkhan Dam in East Azarbayjan (Hajirostamloo, 2009).

Rasouli (2013) found the digenean *Diplostomum spathaceum* in fish from Caspian drainages in West Azarbayjan. This parasite causes secondary infections as the metacercariae penetrate the skin and eye, lesions, appetite loss, blurry vision and reduced feeding. Hosseinifard *et al*. (2014) recorded various nematodes from this fish (as *L*. *cephalus*) in the Garmrud at Amol, Mazandaran. Shokrolahi *et al*. (2014) recorded *Bothriocephalus gowkongensis* (cestode), *Paradiplozoon* sp. (monogenean), *Ichthyophthirius* sp. (protozoan), *Dactylogyrus* sp. and *Rhabdocona* sp. (nematodes) from fish in the Alborz Dam on the Babol River identified as

Leuciscus cephalus. Other parasites were mentioned but not assigned specifically to this species. Hosseini Fard *et al*. (2017) recorded *Ichthyophthirius multifiliis*, *Paradiplozoon* sp., *Myxobolus* sp., *Dactylogyrus lenkorani*, *Gyrodactylus protate* (*sic*, presumably *prostae*) and *Bothriocephalus* sp. in fish from the Chalus River. Taheri Mirghaed *et al*. (2017) recorded parasites from fish in the Alborz Dam and Babol River in Mazandaran, namely *Myxobolus minutus* (dam and river) (Myxozoa), *Dactylogyrus chalcalburni* (river) and *D*. *vistulae* (dam and river), *Paradiplozoon homoion* (dam and river) (Monogenea), *Allocreadium isoproum* (river) and *Bothriocephalus opsariichthydis* (dam and river) and *Ligula intestinalis* (dam) (Digenea), and *Rhabdocona denudata* (river) (Nematoda). Barzegar *et al*. (2018) reported the monogenean *Gyrodactylus ophiocephali* from fish identified as *S*. *cephalus* from the Tajan River in Mazandaran. Taheri Mirghaed *et al*. (2018) reported the protozoans *Ichthyophthirius multifilis* and *Trichodina* sp., the myxozoan *Myxobolus muelleri* and the monogeneans *Dactyolgyrus vistulae*, *Gyrodactylus mutabilitas* and *Paradiplozoon* sp. from the Siah River, the Haraz River (except *Ichthyophthirius multifilis*), and the Neka River (except *Myxobolus muelleri*). Moeini Jazani *et al*. (2019) also examined fish from the Siah River identified as *Squalius cephalus* and found two protozoan species from the gills namely *Ichthyophthirius multifiliis* with the highest numbers in summer and *Trichodina* sp. with the highest numbers in spring, one myxozoan species from the intestine namely *Myxobolus muelleri* with the highest numbers in winter, and three monogenean species namely *Dactylogyrus vistulae* and *Diplozoon paradoxum* from the gills with highest numbers in autumn and summer respectively, and *Gyrodactylus mutabilitas* from the gills and the skin with the highest numbers in summer.

Economic importance. Robins *et al*. (1991) listed this species (as *Squalius cephalus*) as important to North Americans. Importance was based on its use in textbooks and for sport.

Experimental studies. Banagar *et al*. (2013) found copper levels in liver tissue of fish identified as *Squalius cephalus* from the Tajan River were higher than the standard limits set by the World Health Organization. Golmohammadi *et al*. (2013) found a greater zinc accumulation in liver over muscle tissue in fish identified as *Squalius cephalus* from the Tajan River, and levels exceeded the acceptable standard set by the U.K. Ministry of Agriculture Fisheries and Food but lower than other standards.

Conservation. Kiabi *et al*. (1999) considered this species (as *Leuciscus cephalus*) to be of least concern in the south Caspian Sea basin according to IUCN criteria. Criteria included sport fishing, medium numbers, habitat destruction, widespread range (75% of water bodies), present in other water bodies in Iran, and present outside the Caspian Sea basin. Listed as of Least Concern by the IUCN (2015).

Sources. Iranian material:- CMNFI 1970-0506, 6, 42.5-116.3 mm standard length, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0511, 2, not kept, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0512, 1, not kept, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0525, 1, 129.8 mm standard length, Gilan, Sefid River near Mohsenabad (ca. 37º22'N, ca. 49º57'E); CMNFI 1970-0532, 1, 44.1 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0536, 3, 89.0-223.0 mm standard length, Gilan, Siah River estuary near Rudbar (36º53'N, 49º32'E); CMNFI 1970-0537, 8, not kept, Gilan, Shah River above Manjil Dam (36º44'N, 49º24'E); CMNFI 1970-0538, 7, 40.8-137.2 mm standard length, Gilan, Qezel Owzan River above Manjil Dam (36º44'N, 49º24'E); CMNFI 1970-0542, 2, not kept, Gilan, Old Sefid River estuary (37°23'N, 50°11'E); CMNFO 1970-0545, 1, 51.5 mm standard length, Gilan, Sefid River from Emamzadeh Hashem to Lulaman (no other locality data); CMNFI 1970-0546, 3, 52.8-60.7 mm standard length, Gilan, Sefid River canal (no

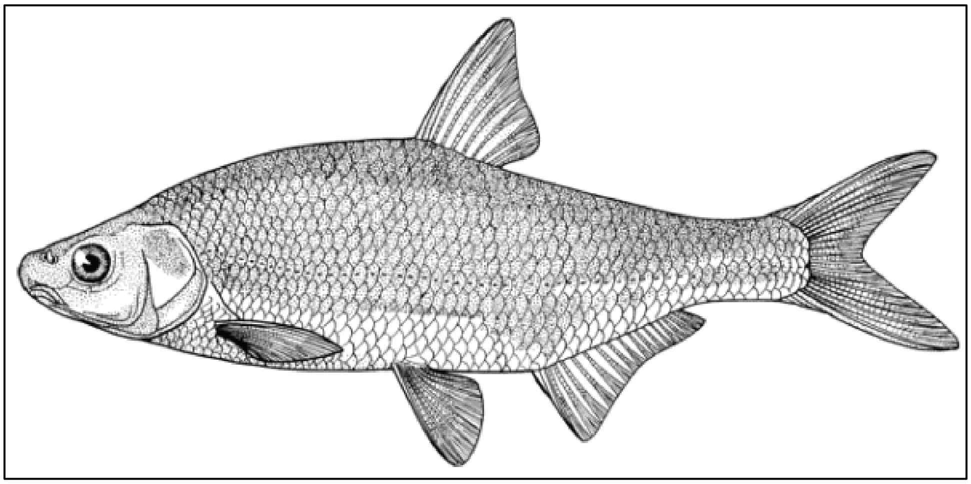
other locality data); CMNFI 1970-0559, 1, 81.7 mm standard lengthy, West Azarbayjan, Baranduz Chay (ca. 37º25'N, ca. 45º10'E); CMNFI 1970-0576, 2, 40.1-62.4 mm standard length, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0583, 6, 41.4-123.8 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0587, 1, not kept, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0589, 1, 142.0 mm standard length, Gilan, Sefid River opposite Kisom (37º12'N, 49º54'E); CMNFI 1979-0430, 3, 49.7-94.8 mm standard length, Mazandaran, river 1 km east of Now Shahr (36º39'N, 51º31'E); CMNFI 1979-0452, 3, 51.7-57.1 mm standard length, East Azarbayjan, Qezel Owzan River 6 km from Mianeh (37º23'N, 47º45'E); CMNFI 1979-0453, 7, 46.7-60.2 mm standard length, Zanjan, Zanjan River (37º06'N, 47º56'E); CMNFI 1979-0469, 6, 86.0-127.5 mm standard length, Mazandaran, river 36 km west of Alamdeh (36º37'30"N, 51º35'E); CMNFI 1979-0473, 4, 31.8-85.6 mm standard length, Mazandaran, Babol River (36º38'N, 52º38'E); CMNFI 1979-0474, 6, 71.3-80.6 mm standard length, Mazandaran, Tajan River (36º34'N, 53º05'E); CMNFI 1979-0475, 2, 34.4-36.6 mm standard length, Golestan, stream on road to Gorgan (36º46'N, 54º00'E); CMNFI 1979-0482, 2, 112.2-160.1 mm standard length, Golestan, river between Minudasht and Dowlatabad (37º19'30"N, 55º31'E); CMNFI 1979-0493, 7, 85.2-114.5 mm standard length, Mazandaran, stream in Tajan River drainage (36º19'N, 53º23'E); CMNFI 1979-0494, 12, 9.1-92.6 mm standard length, Mazandaran, Talar River tributary (36º21'N, 52º51'30"E); CMNFI 1979-0685, 1, 45.0 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0686, 1, 42.8 mm standard length, Gilan, Sefid River above ferry (37º24'N, 49º58'E); CMNFI 1979-0692, 3, 24.0-94.3 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 1979-0695, 2, 47.8-77.4 mm standard length, Gilan, Sefid River at Manjil Bridge (36º46'N, 49º24'E); CMNFI 1980-0120, 2, 41.8-118.1 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1980-0132, 4, 40.1-50.4 mm standard length, Gilan, Sefid River at Kisom (37º12'N, 49º54'E); CMNFI 1980-0155, 1, 56.3 mm standard length, Ardabil, Qareh Su near Ardabil (ca. 38º15'N, ca. 48º18'E); CMNFI 1980-0490, 1, 43.6 mm standard length, Caspian Sea basin (no other locality data); CMNFI 1980-0494, 1, 192.5 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 2007-0082, 1, 35.0 mm standard length, Zanjan, Zanjan River near Zanjan (ca. 36º36'N, ca. 48º32'E); CMNFI 2007-0084, 1, 157.1 mm standard length, East Azarbayjan, Talkheh River basin west of Sarab (ca. 37º56'N, ca. 47º19'E); CMNFI 2007-0092, 5, 90.3-145.7 mm standard length, West Azarbayjan, Zilber Chay (38º42'N, 45º16'E); CMNFI 2007-0098, 5, 116.8-198.1 mm standard length, West Azarbayjan, river south of Mahabad (ca. 36º42'N, ca. 45º41'E); CMNFI 2007-0101, 1, 162.0 mm standard length, West Azarbayjan, Simineh River (ca. 36º54'N, ca. 46º07'E); CMNFI 2007-0103, 2, 36.5-39.4 mm standard length, Kordestan, Zarrineh River basin north of Saqqez (ca. 36º18'N, ca. 46º16'E); CMNFI 2007-0105, 1, 96.9 mm standard length, Kordestan, Zarrineh River basin (ca. 36º06'N, ca. 46º20'E); CMNFI 2007-0106, 1, 80.6 mm standard length, Kordestan, Qezel Owzan River basin near Divan Darreh (ca. 35º52'N, ca. 47º05'E); CMNFI 2008-0086, 1, 154.2 mm standard length, Ardabil, Qareh Su basin near Nir (ca. 38º02'N, ca. 48º00'E); CMNFI 2008-0118, 1, 88.1 mm standard length, Mazandaran, Babol River (no other locality data); CMNFI 2008-0137, 1, 72.0 mm standard length, West Azarbayjan, Zarrineh River (37º05'N, 45º44'E); CMNFI 1980-0149, 4, not kept, Gilan, Chapak River (37º21'N, 49º50'E); CMNFI 2008-0158, 1, 123.3 mm standard length, Lake Urmia basin (no other locality data).

Genus *Vimba*

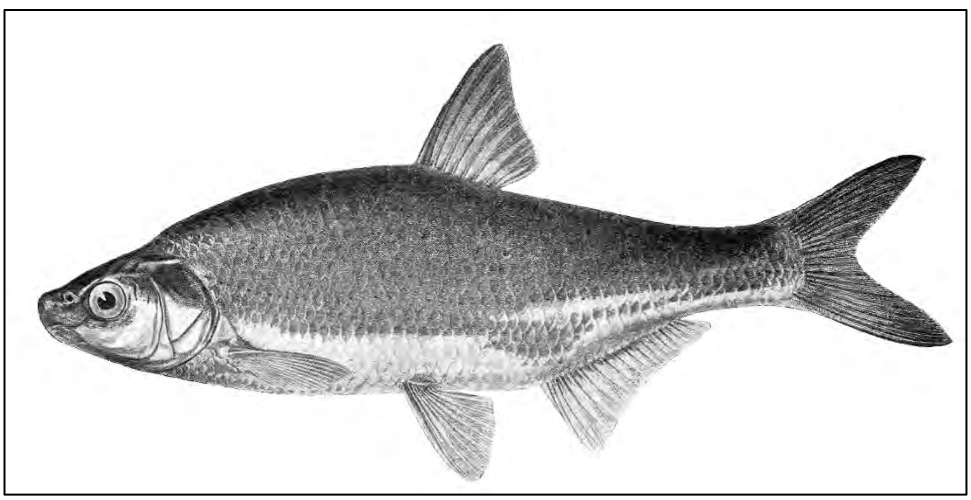
Fitzinger, 1873

This genus is found in the basins of the Baltic, Aegean, Black and Caspian seas and has five species. It is characterised by a compressed, moderately deep body with an inferior, crescentic mouth, a scaleless keel between the pelvic and anal fins, a scaleless groove in front of the dorsal fin and an evident keel behind it, pharyngeal teeth in a single row, short dorsal and long anal fin, gill rakers short, and scales moderate in size. Bogutskaya (1986) using skull morphology reaffirmed the generic separation of *Vimba* Fitzinger, 1873 from *Abramis* Cuvier, 1816 although Howes (1981) considered it to be a synonym.

Vimba persa
(Pallas, 1814)



Vimba persa
Susan Laurie-Bourque @ Canadian Museum of Nature.



Vimba persa, 26.0 cm total length, ZISP 9790, Russia, Volga River near Astrakhan, after Berg (1948-1949).

Vimba persa, CMNFI 1979-0435, Gilan, stream west of Ramsar,
4 June 1978, Brian W. Coad.

Vimba persa, Gilan, Sefid River, April 1999, Keyvan Abbasi.

Common names. Siah kuli, siahkooli or siyah koli (= black fish), cooli, couli, coli, kooli or kuli (= kuli and variants are a general term for any small fish), mahi siah kuli (= black fish).

[Garasol in Azerbaijan; chernospinka, Kaspiiskii rybets or Caspian vimba, both in Russian; Caspian vimba, Persian vimba, southern white-eye, vimba; gypsy king fish (after Sohrabi *et al*. (2013)].

Systematics. *Cyprinus persa* Gmelin, 1774 is a nomen nudum - see Kottelat (1997) - and was later made available by Pallas. It was described originally from “Persa; in lacubus ad Cyrum”, i.e., the southern coast of the Caspian Sea in lakes of the Kura River system in what is now Azerbaijan. No types are known. It is distinguished by larger scales and usually fewer anal rays from *V. vimba* (Linnaeus, 1758) which it was formerly synonymised with or recognised as a subspecies of. *Cyprinus Vimba* was originally described from lakes of Sweden. No types are known. Hänfling *et al*. (2009) found phylogenetically distinct mtDNA sequences for Caspian Sea basin samples, the Caspian clade having diverged from a western or Pontic clade 1-2 MYA at the beginning of the Pleistocene. Caspian populations could then rank as a separate species or subspecies although they considered further work involving western Caucasian populations was needed to support one conclusion over the other. Naseka and Bogutskaya (2009) recognised *V. persa* as a species.

Rahmani and Abdoli (2008) compared populations from the Gorgan River, Shirud and Anzali Lagoon and found morphometric and meristic differences between them. Nejati Javaromi *et al*. (2009) examined fish from the coast of Astara, Bandar-e Torkeman and Tonekabon, using meristic and morphometric characters, and found them not to be completely distinct but possibly from different populations which migrated to these areas. Mohamadian *et al*. (2011, 2011, 2012)

used microsatellite markers on fish from the Anzali Lagoon, Babol River, Gorgan River and Havigh (= Haviq) River and showed significant population structuring, with enormous diversity in the past. Abbasi *et al*. (2013) examined 124 fish from Talesh, Anzali Beach, Kishash (*sic*, possibly Kiashahr), the Chalus coast and Langarud and Tonekabon rivers using 24 morphometric characters and found high phenotypic variation between populations, and the Anzali Beach population was completely isolated from other areas, while samples from the Langarud were very close to samples of west Mazandaran (Chalus coast and Tonekabon River), for example. Vatandoust *et al*. (2014) examined fish from Astara, Bandar-e Anzali, Bandar-e Torkeman, Tonekabon and Sari and using 25 morphometric and 10 meristic characters. They were able to assign 98.3% of individuals to locality on morphometrics and 55.4% on meristics. Population differentiation should therefore be considered in restocking programmes. Rahmani and Kamali Pashakolai (2017) examined 135 fish from the Gorgan and Valiabad rivers and the Larim and Mahmoudabad coastal waters using 27 morphometric and 10 meristic characters and found the populations were not entirely separable.

A hybrid with *Alburnus chalcoides* was reported from the Sefid River (Petrov, 1926) and inheritance of microsatellite markers in this hybrid was investigated by Rouholahi *et al*. (2012).

Key characters. The snout projects over the lower jaw and, in large fish, is quite bulbous, there is a keel on the belly and on the back, and fin ray counts are distinctive.

Morphology. The body is compressed and deep, being deepest at the dorsal fin origin. The predorsal profile is convex and a nuchal hump is often present. The caudal peduncle is compressed and moderately deep. The snout is very to moderately rounded and projects over an oblique mouth. The mouth extends back to a level between the nostril and the eye or to under the nostril. The rear of the eye is at the beginning of the anterior half of the head. The dorsal fin is emarginate and its origin is posterior to the level of the pelvic fin origin. The depressed dorsal fin extends back over the beginning of the anterior third of the anal fin. The caudal fin is moderately to deeply forked with rounded tips. The anal fin is emarginate near its origin and then becomes lower and straight or emarginate. The pelvic fin is rounded and may almost reach back to the anus. The pectoral fin is rounded and does not extend back to the pelvic fin.

Dorsal fin with 2-3 unbranched rays (always 2 in the former subspecies *persa* (Berg, 1948-1949) but the first unbranched ray of 3 is minute and visible in x-rays in Iranian specimens) and 7-9, usually 8, branched rays, anal fin with 3 unbranched and 12-22 branched rays (16-18 in *persa* after Berg (1948-1949) but see below), pectoral fin branched rays 11-18, and pelvic fin branched rays 7-10. Lateral line scales 47-55. The lateral line runs below the midline of the caudal peduncle. Predorsal scales are small and crowded. A pelvic axillary scale is present. The naked ventral keel begins 0-3 scales behind the pelvic fin bases. Scales at the anal fin base form a sheath. The anterior scale margin is wavy and the posterior margin is crenulate. There is a central focus, numerous fine circuli and few anterior and posterior radii. Total gill rakers number 12-20, small and reaching the raker below when appressed. Pharyngeal teeth are usually 5-5, with the largest teeth having long and narrow, flat to slightly concave crowns, and tips recurved or very slightly hooked. The gut is s-shaped. Total vertebrae number 38-45. The chromosome number is 2n = 50 (Klinkhardt *et al*., 1995; Arai, 2011) or 2n = 52 (Reshetnikov, 2002). Pourkazemi *et al*. (2010) found hatchery fish in Iran had 2n = 50 (74.7%), 2n = 48 (14.7%) or 2n = 49 (4.7%).

Jalali *et al*. (2019, 2020) described the ontogenic development of the digestive tract and accessory glands in larval and juvenile fish (identified as *Vimba vimba*), useful in identifying limiting factors in breeding larvae.

Meristic values for Iranian specimens are:- dorsal fin branched rays 7(1) or 8(39), anal fin branched rays 16(3), 17(13), 18(18) or 19(6), pectoral fin branched rays 14(8), 15(22), 16(7) or 17(3), pelvic fin branched rays 8(10) or 9(30), lateral line scales 47(1), 48(4), 49(7), 50(10), 51(14), 52(1), 53(1), 54(1) or 55(1), total gill rakers 15(1), 16(2), 17(12), 18(14), 19(9) or 20(2), pharyngeal teeth 5-5(15), 5-4(4) or 4-5(1), and total vertebrae 41(3), 42(9), 43(24) or 44(3). Abbasi *et al*. (2004) found 149 Sefid River fish to have mean values of 50.83 lateral line scales, dorsal fin branched rays 7.96 and anal fin branched rays 17.58.

Sexual dimorphism. Females are slightly larger than males of the same age and differ morphometrically on account of the eggs distorting body shape. The males become black on the back, reddish on the belly, their fins become red and the tips of the dorsal and caudal fins become dark, and they develop minute tubercles on the body during the spawning season (Kuliev, 1988; Abbasi *et al*., 2004). Females may also develop tubercles but to a lesser extent. Sefid River fish showed differences in two meristic and 16 morphometric characters, especially body depth and lengths of dorsal, pectoral, pelvic and anal fins (Abbasi *et al*., 2004) and sexes from the Anzali Lagoon differed in 12 morphometric characters, especially body height and dorsal and anal fin lengths (Hosseini *et al*., 2012).

Iranian specimens have small tubercles lining the scale margins and larger tubercles over the whole head but particularly on the dorsal surface and upper sides. Fin rays bear small tubercles in files following the branching of the rays. The pelvic fin has weakly developed tubercles on its ventral surface as well as dorsally. The pectoral and pelvic fin unbranched rays bear several rows of tubercles.

Colour. The back is a reddish-brown to grey-blue, flanks are silvery and the belly yellowish. Paired fins are red at the base, pink distally. The anal fin base is red while other fins are grey to hyaline. Spawning fish develop black stripes along the dorsal and ventral body.

Size. Reaches 60.0 cm and 3.0 kg as *Vimba vimba*. *V. persa* is apparently smaller, to 30.5 cm (Rahmani *et al*. 2011).

Distribution. In Iran it is recorded from the whole Caspian Sea basin including the Astara, Babol, Chapak, Chelondchay, Chelvand, Fereydun Kenar, Gholab Ghir, Golshan, Gorgan, Haraz, Haviq, Iz Deh, Kargan, Khoshk, Kiarud, Langarud, Larim, Masuleh-Rukhan, Nahang, Nerissi, Pir Bazar, Polrud (= Pol-e Rud), Qareh Su, Qezel Owzan, Rasteh, Sardab, Sari, Sefid, Shafa, Shah, Shalman, Sheikhan, Shesh Deh, Shirud, Siah, Siah Darvishan, Sorkh, Tajan, Tonekabon and Valiabad rivers, the Fereydun Kenar International Wetland, the Manjil Dam on the Sefid River, the Babol River Dam, Voshmgir Dam on the Gorgan River, the Astara and Anzali talabs, Anzali, Astara and Kiashahr beaches, the Chalus coast, Gorgan Bay, the Anzali and Bandar-e Torkeman coasts, and the southeast, southwest and south-central Caspian Sea (Kozhin, 1957; Nümann, 1966; Holčík and Oláh, 1992; Riazi, 1996; Karimpour, 1998; Abbasi *et al*., 1999, 2007, 2017; Kiabi *et al*., 1999; Abdoli, 2000; Banagar *et al*., 2008; Rahmani and Abdoli, 2008; Abdoli and Naderi, 2009; Nejati Javaromi *et al*., 2009; Piri *et al*., 2009; Nikoo *et al*., 2010; Ahmadpour *et al*., 2012; Abbasi *et al*., 2013; Sohrabi *et al*., 2013; Rahmani and Kamali Pashakolai, 2017; Sattari *et al*., 2020; Abbasi *et al*., 2021). It has also been introduced to Sistan.

Zoogeography. This species reaches its most south-easterly occurrence in Iran. Its relationships lie with European taxa (see *Abramis*).

Habitat. This species is found in rivers, streams, lakes, dams, lagoons, marshes and brackish environments. Caspian vimba have a sparse distribution in the sea and are not fished there commercially. It is more common in Gilan than Mazandaran and Golestan coastal waters

(Naderi Jolodar and Abdoli, 2004). The semi-migratory form enters fresh water or brackish water only for reproduction in spring. After spawning, it migrates to river mouths to feed until the next reproductive season (Kuliev, 1988). Riazi (1996) reported that this species is native (resident) to the Siahkeshim Protected Region of the Anzali Talab. S. Bazari Moghaddam (www.meeresschule.com/cgi-bin/abstracts/gastbuch.asp, downloaded 17 January 2005) recorded a migration into the Sefid River in spring for reproduction. Feeding continued on this migration. Knipovich (1921) reported this species from depths of 36.6-53.0 m in the Iranian Caspian Sea. It has been caught at 31-32°C in the Sefid River estuary on 9 July 1962 (CMNFI 1970-0565, CMNFI 1980-0908). In fresh water it occurs in schools in the lower reaches of rivers, in deep water over stone and gravel bottoms. It may also occur in lakes over mud bottoms.

Shahlapour *et al*. (2018) found only a low abundance of juveniles of this species in the eastern Caspian Sea, attributed to destruction of riverine habitats and illegal fishing of adults.

Habitat of *Vimba persa*, CMNFI 1979-0435, Gilan, stream west of Ramsar, 4 June 1978, Brian W. Coad.

Age and growth. Four-year-olds predominated in the spawning population in Kyzylagach or Imeni Kirova Bay, Azerbaijan. Most spawning females were 16-23 cm (46%) and males 13-19 (42%). Large fish spawned first and the number of smaller fish spawning increased towards the end of the reproductive season (Kuliev, 1988; Shikhshabekov, 1979).

Most fish on the spawning migration into the Anzali Talab were 170-250 mm and ages 3-4 years (Holčik and Oláh, 1992). Maturity was attained in the second or third year of life, males maturing at age 2 in the Anzali region. In the Sefid River migrating fish were 2-4 years old, predominately three-year-old fish (S. Bazari Moghaddam, www.meeresschule.com/cgi-bin/abstracts/gastbuch.asp, downloaded 17 January 2005). Fish on the spawning migration of the Sefid River had a fork length of 116-208 mm and a weight of 21.1-116.1 g in males and 122-222 mm and 23.1-170.0 g in females. Spawning males were 2-6 years old and females 3-7 years (Abbasi *et al*., 2005).

Chaichi (2010, 2011, 2011) found fish from coastal waters of Mazandaran had a male:female sex ratio of 1:1.35, significantly different from the 1:1 ratio, growth was isometric

for females and positively allometric for males, and von Bertalanffy growth and mortality parameters were growth coefficient (K) = 0.28 per year for both sexes (0.3 for males, 0.33 for females), theoretical maximum length (L_∞) = 26.1 cm, hypothetical age for length at age t = 0 (t_0) = -0.65 per year for both sexes (-0.51 for males, -0.23 for females), the growth performance index (Φ') = 2.28, instantaneous coefficient of total mortality (Z) = 0.98-1.07 per year (different values in different papers here and below where two are given, other values the same in all), instantaneous coefficient of natural mortality (M) = 0.58-0.59 per year, instantaneous coefficient of fishing mortality (F) = 0.39-0.49 per year, exploitation coefficient (E) was 0.4-0.46, showing the population was highly exploited and not sustainable as a fishery, total biomass was 1,336 t, and maximum sustainable yield (MSY) was 528.8 t. The oldest fish was 5 years.

Hosseini Kenari *et al*. (2010, 2011) analysed fish from the Kiashahr region in the southwest Caspian Sea and found three age groups 1^+ to 3^+ years, most fish being 2^+ years (84.8%), with a female:male sex ratio of 1:1.38, and a condition factor of 0.98 in males and 1.04 in females. Maximum life span was about 15 years.

Patimar and Safari (2010) found a maximum age of 5 years for fish in the Gorgan Bay-Miankaleh Wildlife Refuge of the southeastern Caspian Sea. The von Bertalanffy growth functions were $L_t = 32.565(1-e^{-0.184(t+0.530)})$ for males and $L_t = 32.95(1-e^{-0.179(t+0.529)})$ for females with a balanced sex ratio but males predominating in smaller age classes and females in larger ones. Rahmani *et al*. (2011) examined fish from the Gorgan River, found a maximum age of 7 years with the most abundant age class 6^+ years in 1999 and 3^+ years in 2000. Growth was allometric. von Bertalanffy growth parameters of L_∞ = 41.65 cm and K = 0.13 yr^{-1} for females in 1999 and L_∞ = 29.52 cm and K = 0.27 yr^{-1} in 2000, higher than in males where L_∞ = 34.1 cm and K = 0.19 yr^{-1} in 1999 and L_∞ = 24.74 cm and K = 0.32 yr^{-1} in 2000**.** Rahmani *et al*. (2011) compared fish from the Gorgan River with those from Mahmoudabad and found a sex ratio of males to females of 67% to 33% for the Gorgan River and 57% to 43% for Mahmoudabad, there was no significant differences for average length and weight, growth patterns were negative allometric and isometric (*cf*. above in another co-authored study), and asymptotic length was higher in males than females in both populations but growth rates were relatively higher in females.

Taridashti *et al*. (2013) examined fish from the Gilan coast for length-weight relationships, females being $W = 0.0085FL^{3.1619}$ and males $W = 0.0126FL^{3.9865}$, weight increasing isometrically with length for both sexes, but for all fish $W = 0.0331FL^{2.6432}$ indicating negative allometric growth. Taridashti *et al*. (2017) examined 811 fish from three fisheries in the southwestern Caspian Sea at Bandar Anzali, Kiashahr and Talesh. Females had a fork length range of 8-24 cm and males 8-20.3 cm. The age range was 0^+ to 7^+ years with females more frequent than males at 4^+ and 5^+ years. The oldest female was 7^+ years and the oldest male 5^+ years. Growth rate was relatively high at about 0.29/year for females and 0.32/year for males. The overall male:female sex ratio was balanced at 1:0.92 and growth was isometric for both sexes. The von Bertalanffy parameters were L_∞ = 24.53 cm, k = 0.28/year and t_0 = -0.53 for females and L_∞ = 23.34 cm, k = 0.33/year and t_0 = -0.29 for males, and k and t_0 were significantly different between sexes. The growth performance index (ϕ') was 2.25 and 2.26 for males and females. The length-weight relationships were $W = 0.0116TL^{3.023}$ for males and $W = 0.0114TL^{3.0307}$ for females, isometric for both sexes. Condition factor for males did not vary monthly but increased considerably for females in June and October coinciding with the spawning season and the beginning of vitellogenesis. The coefficient of total mortality (Z) was 1.27/year, the instantaneous coefficient of natural mortality (M) was 0.46/year, instantaneous

coefficient of fishing mortality (F) was 0.8/year, and exploitation coefficient (E) was 0.63/year. F and Z rates were higher for males. Males grew faster, reached larger sizes and lived for a shorter time than females. The authors noted differences in growth parameters and age range between different regions in the Caspian Sea although comparison with populations outside the Caspian referred to another species, *Vimba vimba*. The population was experiencing significant legal and illegal exploitation pressure.

Karimi *et al*. (2021a) sampled fish from the Kiashahr coast from March 2016 to April 2017. The means of total length and total weight were 17.87 cm and 60.1 g. The relationship between length and weight was highly correlated in both sexes and equations were $W = 0.25L^{2.95}$ for males and $W = 0.21L^{2.82}$ for female, both showing negative allometric growth. The somatic conditions were 1.35 in males and 1.38 in females.

Food. Diet is aquatic insects, crustaceans, snails, worms and algae on muddy bottoms. Iranian specimens had zebra mussels and insect remains. S. Bazari Moghaddam (www.meeresschule.com/cgi-bin/abstracts/gastbuch.asp, downloaded 17 January 2005) reported oligochaetes, chironomids and Odonata in fish from the Sefid River. Chaichi (2010) found fish from coastal waters of Mazandaran were mesophagous and fed on arthropods, worms, plants, detritus and fishes in descending order.

Reproduction. Fish entered the Anzali Talab of Iran in mid-January at a water temperature of 8-9°C, peaking from 21 April-10 May at 19-21°C (Holčík and Oláh, 1992). Khaval (1998) reported a spawning migration into the Sefid River despite construction, sand removal and pollution. Fish from the Shafa River estuary in Iran caught on 10 April 1962 (CMNFI 1980-0121) had highly developed eggs measuring 1.3 mm. Fecundity generally is up to 89,200 eggs per female, increasing with age and body size. Spawning is non-intermittent, in contrast to related Black Sea vimbas. Eggs are deposited on gravel or stones where there is a current of 0.6-0.9 m/second. Concrete structures and flooded fields may be used as long as there is some current (Holčík and Oláh, 1992). The eggs may form a layer up to 10 cm thick. Initially attached to plants or stones, the eggs are later washed down between the plants or stones. Other fishes eat these eggs and mortality is high. Some fish deposited eggs in sandy shallows of bays or on the roots of reeds and bulrushes. The young migrated to the coastal zone of the Caspian Sea for the summer, moving to greater depths as winter approached. At temperatures of 17-22°C, eggs incubated for 70-77 hours (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran,* pp. 37-38, 1996).

Abbasi *et al*. (2005) found that the Sefid River population started the spawning migration in March and this continued until July, peaking in mid-April to late May. Gonad weight for females increased with distance from the estuary. Spawning occurred from late May to late June, peaking in May at 18-29ºC water temperatures. Eggs were shed on pebble and gravel grounds 25-75 km from the estuary. The Disaam tributary was the major spawning site. Chaichi (2010) and Chaichi *et al*. (2011) examined fish from the coastal waters of Mazandaran and found advanced maturity stages in April-May with the highest gonadosomatic index for females in May and the lowest in July, and for males May and October respectively. The average absolute and relative fecundities were 17,198 and 171.85 eggs respectively. Maximum egg production was 34,636 eggs. Hosseini Kenari *et al*. (2010) found Kiashahr region fish to have a maximum absolute fecundity of 13,589 eggs and a maximum relative fecundity of 152 eggs. The gonadosomatic index was highest in May for males and in June for females. Patimar and Safari (2010) found Gorgan Bay-Miankaleh Wildlife Refuge fish to spawn in late April to late May based on the gonadosomatic indices, which were highest in early May for males and in late April

for females (*sic*, compare above). Absolute fecundity reached 36,141 eggs and maximum egg diameter 1.7 mm. Rahmani *et al*. (2011) found Gorgan River fish to have a maximum fecundity of 21,491 eggs, with a mean absolute fecundity of 15,157 eggs in 2009 and 9,852 in 2000, significantly different. The highest gonadosomatic indices for both sexes were at the end of April, with no differences between the two sample years. The mass migration into the river was in the first half of April at a water temperature of 22-23°C (compare above for the Anzali Talab). Rahmani *et al*. (2011) compared fish from the Gorgan River with those from Mahmoudabad and found mean absolute fecundity to be 11,970 and 6,728 eggs respectively, there being significant differences in this and in average egg diameter and condition factor.

Tari *et al*. (2015) examined fish from the fisheries stations of Talesh, Anzali and Kiashahr in the southwest Caspian Sea over a two-year period. Gonadosomatic index peaks were found in June 2012 and May 2013, oocyte development was synchronous, absolute fecundity was 5,873-35,421 eggs, sex ratio was essentially 1:1, size at first maturity (50% mature) for females was 120 mm fork length and all were mature at 180 mm, and the species was a total spawner with variable spawning depending on environmental conditions. Rostamnezhad *et al*. (2019) compared the reproductive ability and histological properties of fish from the Anzali Wetland and the Sefid River, finding significant differences in terms of gonad weight, liver weight, hepatosomatic index, fecundity and relative fecundity, but not length. Reproduction began and ended earlier in the wetland.

Nikoo *et al*. (2010) measured serum sex steroids during spawning in the Valiabad River and concluded that this fish may be a multiple spawner.

Karimi *et al*. (2021b) noted that this species lived mainly in brackish waters and migrated in to rivers for spawning. It was a total spawner and spawning occurred from April to June in water with a temperature of 16 to 20°C.

Kuliev (1988) and Shikhshabekov (1979) studied reproduction in the Kyzylagach Bay of the southwestern Caspian Sea and the waters of Dagestan respectively. The spawning migration began in March or April at 10-13°C and spawning took place at the end of April at 16-20°C, continuing until the end of May or into June.

Parasites and predators. Jalali and Molnár (1990a) recorded the monogeneans *Dactylogyrus cornoides* and *D. haplogonus* from this species in the Sefid River. Sattari *et al*. (2007) recorded the cestodes *Caryophyllaeus laticeps* and *Caryophyllaeus fimbriceps*, the digenean *Diplostomum spathaceum* and the monogenean *Dactylogyrus extensus* in fish from the Anzali Wetland. Barzegar *et al*. (2018) reported the monogeneans *Gyrodactylus katharineri*, *G. mutabilitas* and *G. vimbi* from fish identified as *V. vimba* from the Tonekabon and Talar, Talar and Shirud, and Tonekabon rivers, Mazandaran, respectively.

Economic importance. The vimba catch over the whole Caspian Sea basin was less than 100 tonnes per year in the 1980s (Kuliev, 1988). The catch in Dagestan in 1934 was 1,319 centners or 1,265,000 fish (Berg, 1948-1949). The catch by local fishermen in the Anzali Talab region in 1990-1991 was 823 kg or about 8,400 fish (Holčík and Oláh, 1992). They were caught in rogas and inflowing rivers of the talab in late winter and early spring. In 1994-1995, the population of this species was noted as declining in recent years (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, pp. 37-38, 1996). Chaichi *et al*. (2011) gave a maximum catch in recent years of 474 t in 2009-2010 for Iranian waters and was as low as 9 t in 2005-2006 (Taridashti *et al*., 2017). It is also a sport fishery species in Iran (Rahmani *et al*., 2011). This species is harvested by local people for food (Taridashti *et al*., 2017). Mohamadian *et al*. (2011, 2011, 2012, 2012) differentiated populations genetically along

the Iranian coast and noted that this has significance in conservation and restocking programmes.

Robins *et al*. (1991) listed related species as important to North Americans. Importance was based on its use as food and in aquaculture.

Experimental studies. Shokrzadeh Lamuki *et al*. (2012) evaluated pesticide residues in fish from four major fishing centres (Babol Sar, Chalus, Khazarabad and Miankaleh) and found mean D.D.T. and D.D.A. values both ranged from 0.016 to 0.019 mg/kg. Mansouri Chorehi *et al*. (2013) found Caspian vimba from the Sefid River were highly sensitive to the pesticide diazinon, used in Iranian agriculture, with an LC_{50} 96 h of 0.08 mg/l. Farahbakhsh *et al*. (2017) studied the amount of copper, nickel and zinc in muscle tissue and nickel was higher than international standards, but the potential risk and hazard indicators indicated there was not much danger to consumers. Ettefaghdoost and Noveirian (2019) measured the levels of arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, selenium and zinc in muscle tissue of fish from the Siah Darvishan River and the levels of all except arsenic, lead and manganese were lower than the international standard threshold. Solgi *et al*. (2019) found iron to have the highest metal content in fish from Manjil Dam, the lowest and highest levels of copper, iron and zinc were in muscle and gill tissues, respectively, and copper and zinc levels were lower than international standards while iron was low to high depending on the standard used. Sattari *et al*. (2020) determined the levels of 36 elements in liver and muscle tissue of fish from the southwestern Caspian Sea and the relationship with growth indices (length and weight, condition factor and hepatosomatic index). The highest element concentration reported in muscle and liver belonged to phosphorus. The average concentrations of metals in both tissues were in the order of selenium, potassium, sodium and calcium respectively. Many elements were below detection limits.

Jalali *et al*. (2018) measured mouth size in larval and juvenile fish. They found that with the onset of exogenous feeding, larvae were probably able to ingest and digest 110 µm pellet food eight days after hatching. Formulated diets therefore could only be used 20 days after hatching until the end of the larval rearing period. Cultured fish were released into the Caspian Sea 60 days after hatching.

Catches in the Anzali Wetland were higher using a blue fyke net, compared to red and black (Paighambari *et al*., 2014).

Norousta and Mousavi-Sabet (2013) examined haematological parameters, in mature and immature fish from the mouth of the Sefid River, finding differences between the life stages in total erythrocyte count (lower in mature fish)), total white blood cell count and neutrophil (higher in mature) and rate of clot time (lower in mature). The species also had higher mean values for haematocrit and haemoglobin concentration, similar values for total erythrocyte count, and low percent of heterophils in relation to other cyprinoid species. Sohrabi *et al*. (2013) examined haematological parameters of this species migrating for reproduction in May in the Khoshk River. These parameters are important in managing proposed artificial reproduction of a species, and for assessing health and environmental disturbances.

Conservation. Weirs are a problem for this species in Iran as they block the spawning migration, the fish massing below the obstruction, and causing re-absorption of eggs and sperm (Holčík and Oláh, 1992). Reportedly less than 5% of migratory fish can reproduce naturally and the rest are caught (Karimi *et al*., 2021b). Aquaculture of this species has been investigated in Iran (see above); it could be bred semi-artificially using methods similar to that for *Rutilus* species (*Annual Report, 1994-1995, Iranian Fisheries Research and Training Organization, Tehran*, p. 38, 1996).

Kiabi *et al*. (1999) considered this species to be near threatened in the south Caspian Sea basin according to IUCN criteria. Criteria included commercial fishing, sport fishing, abundant in numbers, habitat destruction, widespread range (75% of water bodies), absent in other water bodies in Iran, and absent outside the Caspian Sea basin. Mostafavi (2007) listed it as near threatened in the Talar River, Mazandaran. Taridashti *et al*. (2017) reported many catches were illegal and made during the spawning season in rivers. Jouladeh-Roudbar *et al*. (2020) listed is as of Least Concern because of its widespread distribution and no known major threat.

Sources. Iranian material:- CMNFI 1970-0509, 1, not kept, Gilan, Sefid River at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0510, 3, 29.1-43.7 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1970-0511, 2, not kept, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1970-0512, 1, not kept, Gilan, Shalman River (37º08'N, 50º15'E); CMNFI 1970-0519, 6, 21.4-28.6 mm standard length, Gilan, Chelvand River (ca. 38º18'N, ca. 48º52'E); CMNFI 1970-0521, 3, not kept, Gilan, Sefid River near Lulaman (no other locality data); CMNFI 1970-0522, 2, 25.9-26.8 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1970-0526, 4, 45.1-60.5 mm standard length, Gilan, Sefid River below Astaneh Bridge (37º19'N, 49º57'30"E); CMNFI 1970-0528, 47, not kept, Mazandaran, Tajan River estuary (36º49'N, 53º06'30"E); CMNFI 1970-0531, 8, 44.4-70.5 mm standard length, Mazandaran, Larim River talab (36º46'N, 52º56'E); CMNFI 1970-0532, 7, 36.8-48.9 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0536, 3, not kept, Gilan, Siah River estuary near Rudbar (36º53'N, 49º32'E); CMNFI 1970-0537, 13, not kept, Gilan, Shah River above Manjil Dam (36º44'N, 49º24'E); CMNFI 1970-0538, 2, 32.8-33.5 mm standard length, Gilan, Qezel Owzan River above Manjil Dam (ca. 36º44'N, ca. 49º24'E); CMNFI 1970-0542, 5, not kept, Gilan, Old Sefid River estuary (37°23'N, 50°11'E); CMNFI 1970-0543, 46, 34.7-50.4 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0543A, 9, 38.9-87.4 mm standard length, Gilan, Caspian Sea at Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1970-0544, 1, 162.2 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1970-0548, 2, not kept, Golestan, Qareh Su (no other locality data); CMNFI 1970-0549, 1, 43.1 mm standard length, Golestan, Qareh Su near Alm Imamzadeh (no other locality data); CMNFI 1970-0563, 17, 40.9-73.1 mm standard length, Gilan, Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0565, 3, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1970-0568, 1, not kept, Gilan, Caspian Sea at Kazian Beach (ca. 37º29'N, ca. 49º29'E); CMNFI 1970-0583, 50, not kept, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0585, 11, 21.5-42.5 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1970-0587, 1, 38.1 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1970-0589, 1, not kept, Gilan, Sefid River opposite Kisom (37º12'N, 49º54'E); CMNFI 1970-0590, 7, not kept, Mazandaran, Shesh Deh River near Babol Sar (ca. 36º43'N, ca. 52º39'E); CMNFI 1971-0343, 1, 57.8 mm standard length, Gilan, Langarud at Chamkhaleh (37°13'N, 50°16'E); CMNFI 1979-0430, 1, 36.1 mm standard length, Mazandaran, river 1 km east of Now Shahr (36º39'N, 51º31'E); CMNFI 1979-0431, 1, 145.0 mm standard length, Mazandaran, bazaar at Now Shahr (no other locality data); CMNFI 1979-0435, 1, 141.1 mm standard length, Gilan, stream west of Ramsar (36º57'N, 50º37'E); CMNFI 1979-0436, 5, 115.1-156.5 mm standard length, Gilan, stream 26 km west of Ramsar (37º02'30"N, 50º27'E); CMNFI 1979-0437, 1, 155.2 mm standard length, Gilan, Sefid River, 2 km west of Astaneh (37º16'30"N, 49º56'E); CMNFI 1979-0438, 2, 139.5-152.6 mm standard length, Gilan, Gholab Ghir River (37º27'N, 49º37'E); CMNFI 1979-0446, 1, 33.8 mm standard length, Gilan, Astara River (38º26'30"N, 48º51'E); CMNFI 1979-

0685, 5, 27.8-56.4 mm standard length, Gilan, Sefid River (ca. 37º22'N, ca. 49º57'E); CMNFI 1979-0686, 2, not kept, Gilan, Sefid River above ferry (37º24'N, 49º58'E); CMNFI 1979-0689, 11, not kept, Gilan, Sefid River at Hasan Kiadeh (37º24’N, 49º58’E); CMNFI 1979-0696, 13, not kept, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1979-0788, 2, 28.5-50.7 mm standard length, Golestan, Gorgan River at Khadje Nafas (37º00'N, 54º07'E); CMNFI 1980-0116, 1, 36.1 mm standard length, Gilan, Sefid River at Astaneh Bridge (37º16'30"N, 49º56'E); CMNFI 1980-0117, 1, 33.9 mm standard length, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0120, 7, 47.5-63.7 mm standard length, Mazandaran, Babol River at Babol Sar (36º43'N, 52º39'E); CMNFI 1980-0121, 3, 139.5-152.2 mm standard length, Gilan, Shafa River estuary (37º35'N, 49º09'E); CMNFI 1980-0122, 4, 35.3-45.1 mm standard length, Mazandaran, Nerissi River (36º38'N, 52º16'E); CMNFI 1980-0123, 2, 34.1-37.0 mm standard length, Gilan, Sefid River around Dakha (ca. 37º22'N, ca. 49º57'E); CMNFI 1980-0126, 1, 170.8 mm standard length, Gilan, Caspian Sea near Bandar-e Anzali (37º28'N, 49º27'E); CMNFI 1980-0127, 2, 180.3-182.1 mm standard length, Gilan, Caspian Sea near Hasan Kiadeh (37º24'N, 49º58'E); CMNFI 1980-0129, 1, 51.9 mm standard length, Mazandaran, Tajan River (36º49'N, 53º06'30"E); CMNFI 1980-0130, 4, 22.7-33.9 mm standard length, Mazandaran, Iz Deh near Shilat Post (36º36'N, 52º07'E); CMNFI 1980-0131, 5, 26.2-34.4, Iran Caspian Sea basin (no other locality data); CMNFI 1980-0135, 1, 56.2 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 1980-0136, 3, not kept, Mazandaran, Fereydun Kenar River estuary (36º41'N, 52º29'E); CMNFI 1980-0138, 10, 28.1-105.0 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E); CMNFI 1980-0139, 3, not kept, Gilan, Golshan River (37º26'N, 49º40'E); CMNFI 1980-0140, 10, not kept, Gilan, Astara Talab close to sea (ca. 38º26'N, ca. 48º53'E); CMNFI 1980-0142, 1, 180.1 mm standard length, Gilan, Nahang Roga River (37º28'N, 49º28'E); CMNFI 1980-0144, 53, not kept, Mazandaran, Sorkh River (36º40'N, 52º25'E); CMNFI 1980-0149, 2, 36.6-37.8 mm standard length, Gilan, Chapak River (37º21'N, 49º50'E); CMNFI 1980-0160, 3, 49.6-73.4 mm standard length, Iran, Caspian Sea basin (no other locality data); CMNFI 1980-0908, 4, 87.8-135.7 mm standard length, Gilan, Sefid River estuary (ca. 37º28'N, ca. 49º54'E).

Bibliography

This section contains all the papers and books referred to in the text and also attempts to be a bibliography on cyprinoid fishes of Iran and their environment.

The suborder Cyprinoidei encompasses a number of families, of which seven are found in Iran, and these were formerly subfamilies of the family Cyprinidae. The Bibliography includes papers and books on the seven families although five of the families (indicated by an asterisk below) are published separately as papers (see Coad (2018b, 2018c, 2019b, 2019c, 2020)). A few important works on the five families that appeared after they were published are also included here but the bibliographies on these five families are only up-to-date as of their publication.

Family **Cyprinidae** Rafinesque, 1815 (carps)
*Family **Danionidae** Bleeker, 1863 (danionids)
*Family **Xenocyprididae** Günther, 1868 (East Asian minnows)
*Family **Tincidae** Jordan, 1878 (tenches)
*Family **Acheilognathidae** Bleeker, 1863 (bitterlings)
*Family **Gobionidae** Bleeker, 1863 (gobionids)
Family **Leuciscidae** Bonaparte, 1835 (minnows)

Some works listed here may not be cited in the text, as they duplicate other papers, mention cyprinids only in passing, or are abstracts or titles from conference papers with little content, some of which were replaced by full papers later, but are cited here for completeness. Some few citations may have only the doi (digital object identifier) as the paper had not appeared in a volume and issue when this book was finished or a paper version could not be located. A few articles appeared online but seemingly were never formally published. Some articles may be marked as "in press" being online versions not yet published with volume and page numbers or doi. These and the doi citations were updated when possible; others can easily be updated by an online search. Most websites are cited in the text, with some in the Bibliography, as sources of information although the web address may no longer be functional. Newspaper articles are cited by name of the newspaper and the date. Newspapers and other news outlets have websites and can be searched although some appear to have been hacked or replaced, e.g., www.netiran.com, but are still the cited as the original source. A more extensive bibliography on Iranian freshwater fishes generally can be found at www.briancoad.com.

The Scientific Information Database or SID, Tehran (www.sid.ir/) appears in Farsi and English, and lists publications in Iranian journals, with abstracts in English and Farsi. Papers generally in the current work may be in languages other than English and this is mentioned (or implied by the translated title) where known although some Iranian-based papers have only been seen as an English abstract (refer to SID). Most Iranian papers in Farsi have an English abstract.

Aquatic Commons (http://aquaticcommons.org/) covers natural marine, estuarine/brackish and fresh water environments including papers in Farsi from Iran with English abstracts. Note that some works are cited as having a single author (the lead or principal author) while others have numerous authors (the team working on the project, sometimes over 20 individuals - apologies for not always including all team members). Either one is easy to locate.

Older classical works are now readily available on-line at, for example, the Biodiversity Heritage Library (www.biodiversitylibrary.org), or can simply be googled for other sources.

Many Iranian-based journals and their papers along with M.Sc. and Ph.D. theses are, naturally, in Farsi but this is not always noted in the absence of the full paper, only an English abstract having been seen. Some journals have an English name in an English abstract, which is followed here, but a direct Farsi translation may differ. Some abstracts in English of Farsi papers only give the senior author's name and not the other authors of the paper. This could not always be checked so apologies to anyone inadvertently omitted.

Some Iranian journals have titles that are the same as distinct journals published in English in other countries. The difference is evident when "In Farsi" is added at the end of the citation.

The names of one journal have changed over time - "Iranian Journal of Fisheries Sciences", "Iranian Fisheries Scientific Journal", "Iranian Fisheries Journal", "Iranian Fisheries Scientific Bulletin" and "Iranian Fisheries Bulletin", was published in Farsi with English abstracts. It now appears as the "Iranian Scientific Fisheries Journal" in Iranian abstracting journals and websites but references may appear here under the older, original journal names. The "Iranian Journal of Fisheries Sciences" (starting in January 1999 with volume 1(1)) is published in English with Farsi abstracts. The Iranian Fisheries Research Organization (formerly Iranian Fisheries Research and Training Organization) publishes these journals and has a website with lists of publications.

Some papers have been reprinted under the journal title "New Technologies in Aquaculture Development (Journal of Fisheries)" (at volume 14 in 2020) and appeared earlier and were cited here under "Journal of Fisheries". These have not been repeated here. Not all papers are repeated and pagination as well as year differs in some. Both versions appeared in Farsi with an English abstract. On-line searches for the articles by title or author may appear in either version. There is also another "Journal of Fisheries" appearing in Farsi (at volume 73 in 2020) and the "New Technologies…" version is presumably to avoid confusion.

Note that Iranian surnames may be compound, comprised of two components, with either the first or second component often ending in the -i suffix, or both ending in that suffix (the second in the latter case usually referring to a geographic location, e.g., Langarudi). The names may be separated, hyphenated or joined and generally appear in this sequence in the Bibliography. Such names may be cited with both (a recent innovation), or only one, of these components in papers and inadvertently herein - authors may then appear in three, relatively adjacent, places in the Bibliography. Names are also transliterated in various ways by authors themselves and by journals, e.g., Langarudi, Langrudi, Langaroodi, Langaroudi, Langroodi, Langroudi; and sometimes with a different initial letter, or a quite different spelling. The names are generally left as seen in the paper or abstract to facilitate searches of the original paper. Letters of the alphabet in Farsi include some transliterated as two letters in English (e.g., gh, kh, sh, zh) so first names of authors may have this double abbreviation, or not. And first names may be compound. The first name Gholamreza, for example, could appear as the initials G. R., Gh. R., Gh. or G. Some explanation of Persian name structure is given by Megerdoomian (2008).

Major spelling errors or other faults in citations are indicated by "(*sic*)" meaning thus; minor ones are generally ignored especially in translation from Farsi in abstracts. Titles translated into English do not always agree fully with the original language but are generally consistent, and different sources vary in their translations. Some translated titles are given as originally cited for ease of retrieval even though the grammar and spelling are incorrect. Almost all scientific names are italicised in the original, occasionally some are underlined and rarely some are in quotes or not italicised. Some may not have been italicised in the original but are

here for emphasis as the original work was not seen.

Papers and books in Farsi are cited in English for ease of access by those readers unfamiliar with Farsi. This also avoids mistakes in writing and orthography and, as Farsi reads from right to left, in layout.

Some Iranian journals give volume, issue and sequential publication number. The latter is variably included here. Some volumes may give both or only the latter within that journal. The Iranian year runs from March to March so papers in Farsi without the Iranian month indicated may bear an incorrect English year when transposed. This would only be of significance for taxonomic reasons and this applies to none of the papers in Farsi. Papers may now appear on-line in the year before paper publication - the latter year is followed here (see Zareian *et al*. (2018) as an example). Some journals have issues appearing on-line as early as July but dated in the next year. Unless nomenclatorial issues are involved, the date appearing on the paper is used. Increasingly, journals use a unique article number (an abbreviated form of an article's digital object identifier) instead of the page range in the citation. And rarely a unique article number is given rather than pages.

The growth in literature on Iranian freshwater fishes, or literature of relevance to that fauna, can be summarised by number of publications by decadal interval years as follows:- 1954 (4), 1964 (9), 1974 (22), 1984 (40), 1994 (70), 2004 (124) and 2014 (497), for example. Over the five-year period 2013-2017 an average of 450 publications per year appeared.

A

Aalipour, M., Keivany, Y. and Ebrahimi, E. 2019. Feeding habits of rainbow trout (*Oncorhynchus mykiss*) in Beheshtabad River of Chaharmahal & Bakhtiari Province. Journal of Applied Biology, 32(1):76-97. In Farsi.

Aazami, J. and Alavi Yeganeh, M. S. 2021. A checklist of fish in Ghezel Ozan river, Mahneshan city, Zanjan province. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 4 pp. In Farsi.

Aazami, J., Esmaili Sari, A., Abdoli, A., Sohrabi, H. and Van den Brink, P. J. 2015. Assessment of ecological quality of the Tajan River in Iran using a multimetric macroinvertebrate index and species traits. Environmental Management, 56(1):260-269.

Aazami, J., Esmaili-Sari, A., Abdoli, A., Sohrabi, H. and Van den Brink, P. J. 2015a. Monitoring and assessment of water health quality in the Tajan River, Iran using physicochemical, fish and macroinvertebrate indices. Journal of Environmental Health Science and Engineering, 13:29.

Aazami, J., Esmaili-Sari, A., Abdoli, A., Sohrabi, H. and Van den Brink, P. J. 2015b. Length-weight relationship of 14 fish species from Tajan River, southern Caspian Sea basin, Iran. Iranian Journal of Ichthyology, 2(4):299-301.

Abadi, M., Zamani, A. A., Parizanganeh, A., Khosravi, A. and Badiee, H. 2019. Heavy metal contamination in surface sediments of four important rivers leading to the Caspian Sea. Journal of Wetland Ecobiology, 11(2):83-96. In Farsi.

Abadi, M., Zamani, A. A., Parizanganeh, A., Khosravi, Y. and Badiee, H. 2017. Mercury concentrations in water and fish samples along south coast of the Caspian Sea. Iranian Journal of Health and Environment, 10(3):329-338. In Farsi.

Abaee, S. 2001. Rapid assessment of point sources pollution in Iranian part of Caspian Sea area

using GIWA methodology. Caspian Environment Programme, Baku, Azerbaijan and Tehran. 8 pp., 3 figs., appendices A-B.

Abarghouei, S., Hedayati, S. A., Ghorbani, R., Kolangi Miyandareh, H. and Bagheri, T. 2015. Investigating toxicity effect of silver nano particles (NanoKa) on some hematological indices of goldfish *Carassius auratus* (Linnaeus, 1758). Journal of Applied Ichthyological Research, 3(2):69-78. In Farsi.

Abarghouei, S., Hedayati, S. A., Ghorbani, R., Paknejad, H. and Bagheri, T. 2020. Evaluation of sub lethal concentration toxicity of silver nitrate ($AgNO_3$) on some hematology and immunology indices in goldfish (*Carassius auratus*). Journal of Environmental Science and Technology, 22(2):57-66. In Farsi.

Abarghouei, S., Hedayati, A., Raeisi, M., Shirkavand Hadavand, B., Rezaei, H. and Abed-Elmdoust, A. 2021. Size-dependent effects of microplastic on uptake, immune system, related gene expression and histopathology of goldfish (*Carassius auratus*). Chemosphere, 276:129977.

Abarghouei, S., Hedayati, S. A., Raeisi, M., Shirkavand Hadavand, B., Rezaei, H. and Abed-Elmdoust, A. 2020. Effect of different sizes and concentrations of polystyrene microplastic on the histopathology of goldfish (*Carassius auratus*). Journal of Aquaculture Sciences, 8(2):24-36. In Farsi.

Abasi, F. and Mohammadzadeh Baran, S. 2010. Study of different concentrations of $HgCl_2$ effects on ovary tissue in the Caspian roach (*Rutilus rutilus*) in vitro conditions. Journal of Applied Biology, 23(1):30-39. In Farsi.

Abasi Dehkord, I., Hashemzadeh Segherloo, I., Poria, M. and Khajeh, P. 2018. Analysis of phylogenetic status of *Luciobarbus esocinus*, *Luciobarbus xanthopterus*, *Tor grypus*, and *Mesopotamichthys sharpeyi*. Journal of Fisheries (Iranian Journal of Natural Resources), 71(2):159-166. In Farsi.

Abaychi, J. and Al-Saad, H. T. 1988. Trace elements in fish from the Arabian Gulf and the Shatt al-Arab River, Iraq. Bulletin of Environmental Contamination and Toxicology, 40(2):226-232.

Abaychi, J. K., Darmoian, S. A. and DouAbul, A. A. Z. 1988. The Shatt al-Arab River: A nutrient salt and organic matter source to the Arabian Gulf. Hydrobiologia, 166(3):217-224

Abbasi, F., Ghorbani, R., Mahini, A. S., Ramezanpour, S. S., Trueman, C. N. and Jackson, A. L. 2020. Shape analysis of sagittal otolith a tool for probable detection of Caspian kutum *Rutilus kutum* Kamenskii, 1901 on the southern coast of the Caspian Sea. Journal of Applied Ichthyological Research, 7(4):13-32. In Farsi.

Abbasi, F., Ghorbani, R., Molaei, M., Naeimi, A., Karimian, E. and Shirood Mirzaei, F. 2014. Fish biodiversity in Shirabad stream (Gorganrood basin, Golestan province). Journal of Applied Ichthyological Research, 1(4):11-24. In Farsi.

Abbasi, F., Ghorbani, R., Yelghi, S., Hajimoradloo, A. and Molaei, M. 2013. Comparative analyses of the diet of spirlin (*Alburnoides eichwaldii*) in the Tilabad, Shirabad and Kaboodval streams Golestan Province, Iran. World Journal of Fish and Marine Sciences, 5(1):79-83.

Abbasi, F., Mehravar, S., Ghorbani, R. and Moghimi, A. 2014. An investigation of diet of spirlin, *Alburnoides eichwaldii* in Kaboodval, Shirabad, Tilabad and Zaringol Streams, Golestan province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Abbasi, J. 2002. Endoparasites of native fishes in northern parts of West Azerbaijan Province. Doctor of Veterinary Medicine Thesis, Islamic Azad University, Urmia Branch, Urmia. 170 pp.

Abbasi, K. 2003. First record of black carp, *Mylopharyngodon piceus* from southern Caspian Sea (Iran). Iranian Scientific Fisheries Journal, 12(2):139-146. In Farsi.

Abbasi, K. 2005. Studying alien fishes and macrocrustaceans distribution and their effects on rivers and wetlands of the Iranian basin of Caspian Sea. Borok II, International Workshop, Invasions of Alien Species in Holarctic, 27 September-1 October 2005, Borok (abstract).

Abbasi, K. 2006a. Identification and distribution of fish fauna in Shafarud River, Guilan Province. Iranian Scientific Fisheries Journal, 15(2):73-86. In Farsi.

Abbasi, K. 2006b. Identification and distribution of fish fauna in Hevigh River (Guilan Province). Iranian Journal of Biology, 18(4):370-382. In Farsi.

Abbasi, K. 2009. Studying native fishes in Hamadan province (Iran). Agricultural Research and Education Organization, Iranian Fisheries Research Institute, Tehran. MS Report, 165 pp. In Farsi.

Abbasi, K. 2017. Fishes of Guilan. Iliya Culture Publication, Rasht. 206 pp. In Farsi.

Abbasi, K., Abdollapour, H. and Khodaparast, H. 2004. Study on fish diversity, position, catch, abundance and distribution in Anzali wetland (Northern Iran, Caspian Sea basin). Report for Japanese International Corporation Agency (JICA). Caspian Sea Bony Fishes Research Center, Anzali, Iran. 108 pp.

Abbasi, K., Akbarzadeh, A. and Sarpanah, A. 2013. The population structure of Caspian vimba, *Vimba persa* in southern Caspian Sea using truss morphometric and meristic characters. Journal of Utilization and Cultivation of Aquatics, 2(2):33-48. In Farsi.

Abbasi, K., Bandani, G., Sayadrahim, M., Sabkara, J. and Tavakoli, M. 2017. Studying Caspian roach, *Rutilus caspius* biology in Guilan Province shores. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 842-849. In Farsi.

Abbasi, K., Esmaeili Fereidoni, A., Sayyad Bourani, M. and Rahmani, H. 2019. Fecundity of wild common carp, *Cyprinus carpio*, in Anzali Wetland. Journal of Aquaculture Development, 13(1):103-119. In Farsi.

Abbasi, K., Esmaeili Fereidoni, A., Sayyad Bourani, M. and Rahmani, H. 2022. Study on main reproductive characteristics of wild common carp, *Cyprinus carpio*, in Anzali Lagoon. Journal of Wetland Ecobiology, 13(1):in press. In Farsi.

Abbasi, K. and Ghafouri, Z. 2020. Length-weight relationship and condition factor of blackbrow bleak (*Acanthobrama microlepis*) from Ghezel-Ozen and Sefid-rivers of Caspian Sea basin. 8th Iranian Conference of Ichthyology, Tarbiat Modares University, November 2020 (abstract).

Abbasi, K., Ghafouri, Z. and Sarpanah, A. 2020. Study of fecundity in *Alburnus sellal* Heckel, 1843 in Gamasiab River Tigris basin (Iran). 8th Iranian Conference of Ichthyology, Tarbiat Modares University, November 2020 (abstract).

Abbasi, K., Hosseinjani, A., Moradi Chafi, M., Sayadrahim, M., Zahmatkesh, Y., Nikpour, M., Khatib, S., Sabkara, J. and Ghane, A. 2018. Study on feeding habit of *Scardinius erythrophthalmus* in Anzali Wetland. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Abbasi, K., Keyvan, A. and Ahmadi, M. R. 2004. Morphometric and meristic characteristics of

Vimba vimba persa in Sefidrud River. Iranian Scientific Fisheries Journal, 13(1):61-76. In Farsi.

Abbasi, K., Keyvan, A. and Ahmadi, M. R. 2005. Studying natural reproduction, spawning grounds and spawning period of *Vimba vimba persa* population in Sefid-Roud River, Guilan Province in north Iran. Iranian Scientific Fisheries Journal, 14(3):113-126. In Farsi.

Abbasi, K., Khatib, S., Sabkara, J., Sayadrahim, M., Makaremi, M., Moradi, M. and Madadi, F. 2017. Studying feeding habits of Prussian carp, *Carassius gibelio*, in Anzali Wetland. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Abbasi, K., Khatib, S., Sabkara, J., Zahmatkesh, Y., Makaremi, M., Moradi Chafi, M., Sayadrahim, M., Nikpour, M. and Madadi, F. 2018. Study of dietary overlap between *Carassius gibelio* and *Cyprinus carpio* in Anzali Wetland. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Abbasi, K., Khatib, S., Sayadrahim, M., Moradi, M., Nikpour, M. and Sarpanah, A. N. 2016. Studying diet priority of *Rutilus frisii*, fingerling in Sefidrud River estuary. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abbasi, K., Khodaparast, H., Moradi, M. and Sarpanah, A. N. 2016. Identification and abundance of fishes in Kardeh Reservoir (Mashad, Iran). The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abbasi, K., Moradi, M., Abdolmaleki, S., Fadayi, B., Kaymaram, F. and Ghasemi, S. 2015. Study of staying time of released kutum, *Rutilus kutum* fingerlings in Sefidrud River. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 137-138.

Abbasi, K., Moradi, M., Bagheri, S., Nikpoor, M., Hasaninia, A., Sayadrahim, M. and Abdoli, A. 2017. Study on population structure of fish in Lake Chitgar of Tehran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 855-861. In Farsi.

Abbasi, K., Moradi, M., Mirzajani, A., Nikpour, M., Zahmatkesh, Y., Abdoli, A. and Mousavi-Sabet, H. 2019. Ichthyo-diversity in the Anzali Wetland and its related rivers in the southern Caspian Sea basin, Iran. Journal of Animal Diversity, 1(2):90-135.

Abbasi, K., Moradi, M., Nikpoor, M., Zahmatkesh, Y., Mirzajani, A., Mousavi-Sabet, H., and Sadeghinejad, E. 2018. Problems of migration and proliferation of migratory fish to Anzali wetland and its rivers, problems and solutions. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Abbasi, K., Moradi, M., Nikpoor, M., Zahmatkesh, Y., Sarpanah, A. and Ghane, A. 2021. Study of fish diversity and abundance in Masuleh-Rukhan River, Anzali Wetland basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Abbasi, K., Moradi, M., Sarpanah, A., Mousavi-Sabet, H., Nikpoor, M., Zahmatkesh, Y. and Mirzajani, A. 2021. Abundance of native fish species and their protection necessity in the Anzali Lagoon. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan,

24th February 2021 (abstract).

Abbasi, K., Moradi, M., Zahmatkesh, Y., Nikpoor, M., Sarpanah, A. and Mousavi-Sabet, S. H. 2021. Study of fish distribution in Pirbazar River tributaries, Anzali Wetland basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Abbasi, K., Moradkhah, S. and Sarpanah, A. N. 2007. Identification and distribution of fish fauna in Siahdarvishan River (Anzali Wetland basin). Pajouhesh va Sazandegi, 19(1)(74):27-39. In Farsi.

Abbasi, K., Mouludi Saleh, A. and Eagderi, S. 2021. Morphological diversity of the Caspian asp, *Leuciscus aspius*, in the South Caspian Sea basin (Osteichthyes: Cyprinidae). Zoology in the Middle East, 67(1):25-31.

Abbasi, K., Mouludi-Saleh, A., Eagderi, S. and Nikmehr, N. 2021. Morphological diversity, indices of length-weight relationship and status of autumn and spring populations of *Alburnus chalcoides* (Gueldenstaedt, 1772) from Sefid and Siahdarvishan rivers in the southern Caspian Sea basin. Journal of Fisheries (Iranian Journal of Natural Resources), 74(1):73-83. In Farsi.

Abbasi, K., Mouludi-Saleh, A., Eagderi, S. and Sarpanah, A. 2019. Length-weight relationship and condition factor of eight species of the genera *Capoeta*, *Garra*, *Chondrostoma*, *Schizothorax* and *Paraschistura* from Iranian inland waters. Iranian Journal of Ichthyology, 6(4):264-270.

Abbasi, K., Mouludi-Saleh, A., Eagderi, S. and Sarpanah, A. 2020. Morphometric and meristic comparison of *Garra rufa* Heckel, populations in rivers of the Karkheh and Karun basins. Journal of Animal Environment, 12(4):465-472. In Farsi.

Abbasi, K., Nikseresht, K. and Noroozi, H. 2009. Identification of fish population in Agh-Gol, Pir-Salman, Gamasiab and Haram-abad wetlands of the Hamadan Province. Journal of Wetland Ecobiology, 1(1):71-90. In Farsi.

Abbasi, K., Noroozi, H. and Sayyad Rahim, M. 2011. Identification, abundance and biodiversity, richness and evenness indices in Karganrud River fishes (Guilan Province). Journal of Fisheries, 5(2):113-126. In Farsi.

Abbasi, K. and Sabkara, J. 2004a. Studying food items of *Leuciscus ulanus*, an endemic fish species in Iran. The 1st Congress on Animal and Aquatic Sciences, University of Tehran, 31 August - 2 September 2004, pp. 492-495.

Abbasi, K. and Sabkara, J. 2004b. Studying some biological characteristics of *Leuciscus ulanus* (Cyprinidae), an endemic fish and little-known in Iran. 2nd International Conference on Applied Biology, Mashad, 29-30 September 2004, p. 29.

Abbasi, K., Salavatian, S. M. and Abdollapoor, H. 2005. Investigating fish diversity and distribution in the Mahabad-Chai River of the Lake Urmia basin, north-western Iran. Iranian Scientific Fisheries Journal, 13(4):75-94. In Farsi.

Abbasi, K., Salavatian, S. M. and Abedini, A. 2017. Identification, abundance and length, weight and age composition of fishes in Arasbaran reservoir. New Technologies in Aquaculture Development (Journal of Fisheries), 10(4):33-38. In Farsi.

Abbasi, K. and Sarpanah, A. 2001. Fish fauna investigation in Aras Reservoir and its Iranian tributaries. Iranian Scientific Fisheries Journal, 10(2):41-62. In Farsi.

Abbasi, K., Sarpanah, A. N. and Nezami, S. 1998. A survey on fish diversity (Ichthyofauna) of Sefidroud River. Pajouhesh va Sazandegi, 39(2):104-109. In Farsi.

Abbasi, K., Sarpanah, A. N., Sadeghinezhad, E., Nikseresht, K., Roohani, A., Mirzajani, A., Noroozi, H., Sayadrahim, M., Zahmatkesh, Y., Sabzi, M., Ramzani, R., Adeli, Y., Ladeni, R. and Sadaghatkish, A. 2014. Studying native fishes in Hamadan province. Inland Waters Aquaculture Research Center, Agricultural Research, Education and Extension Organization, Iranian Fisheries Research Organization, Ministry of Jihad-e-Agriculture, Tehran. 127 pp. In Farsi.

Abbasi, K., Valipour, A., Talebi Haghighi, D., Sarpanah, A. and Nezami, Sh. 1999. Atlas of Iranian Fishes. Gilan Inland Waters. Gilan Fisheries Research Centre, Rasht. vi + 113 pp. In Farsi.

Abbasi, M. and Gharezi, A. 2008. Morphology and histology of the digestive tract of Iranian blind cave fish (*Iranocypris typhlops*). Iranian Veterinary Journal, 4(2)(19):60-69. In Farsi.

Abbasi, M. R., Paighambari, S. Y., Pouladi, M. and Ghorbani, R. 2017. Catch composition, length frequency and biomass of commercial carps in Zayandehrud dam, Isfahan Province, Iran. Biodiversitas, 18(3):939-944.

Abbasi Dobandar, M., Mabudi, H. and Javadzadeh, N. 2017. Comparison of two anesthetic concentrations of 2-Phenoxyethanol and MS-222 on stress indicators (glucose and cortisol) levels in *Arabibarbus grypus*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 610-615. In Farsi.

Abbasi Dobandar, M., Mabudi, H. and Javadzadeh, N. 2019. Determination of the effective anesthetic dose of MS-222 and 2-phenoxy ethanol and comparison their effects on some blood biochemical indicators in *Barbus grypus*. Journal of Animal Biology, 11(4):47-55. In Farsi.

Abbasi Ghadikolaei, H., Kamali, A., Soltani, M. and Sharifian, M. 2018. Study on *Zingiber officinale* powder activities in some growth indices of *Cyprinus carpio*. Journal of Aquaculture Development, 12(1):45-54. In Farsi.

Abbasi Ranjbar, K., Mouludi Saleh, A., Eagderi, S. and Sarpanah, A. 2018. Distinguishing meristic and morphometric traits in three species of the genus *Acanthobrama* from Iranian inland waters. Journal of Taxonomy and Biosystematics, 10(36):49-58, 4. In Farsi.

Abbasimesrdashti, R., Sajjadi, M. and Falahatkar, B. 2020. Combined effect of density and feeding strategy on growth and hematological parameters of *Cyprinus carpio* var. *koi*. Journal of Animal Environment, 12(2):209-220. In Farsi.

Abbasov, G. S. 1980. The ichthyofauna of the main freshwater bodies of Azerbaidzhan. Journal of Ichthyology, 20(4):140-142.

Abbaspour, M. and Sabetraftar, A. 2005. Review of cycles of drought and indices of drought and their effect on water resources, ecological, biological, agricultural, social and economical issues in Iran. International Journal of Environmental Studies, 62(6):709-724.

Abbaspour, R., Alipour, A., Mesgaran Karimi, J. and Mohamadi, M. 2013. The study of morphometric-meristic characters, diet and fecundity indices of anjak fish (*Schizocypris brucei*) in Hamoun Wetlands of Iran. Journal of Animal Biology, 5(3):43-50. In Farsi.

Abbaspour, R., Hassanzadeh, H., Alizadeh Sabet, H., Hedayatifard, M. and Mesgaran Karimi, J. 2014. Water quality assessment of Cheshmekileh River with using community of macrobenthic invertebrates and physicochemical factors of water. Journal of Aquaculture Development, 7(4):43-56. In Farsi.

Abbaspour, R., Hedayatifard, M., Alizadeh Sabet, H. R., Hassanzadeh, H. and Mesgaran Karimi,

J. 2014. Bioassessment of macrobenthic fauna of the Cheshmeh Kileh River, northern Iran. American-Eurasian Journal of Agriculture and Environmental Sciences, 13(6):747-753.

Abbaspour, R., Rahbar, M. and Karimi, J. M. 2013a. Comparative survey of morphometric-meristic male and female anjak fish (*Schizocypris brucei*, Annandale and Hora, 1920) of Hamoun Wetland in South East Iran. Middle-East Journal of Scientific Research, 14(5):620-623.

Abbaspour, R., Rahbar, M. and Karimi, J. M. 2013b. Study of the fecundity indices and diet of *Schizocypris brucei* in Hamoun Wetlands in south east Iran. World Journal of Fish and Marine Sciences, 5(5):481-485.

Abbaszadeh, M. and Şişman, T. 2021. An application of histological technique for monitoring health status of fish species, *Leuciscus aspius* (Linnaeus, 1758) inhabiting Aras River, Iran. Caspian Journal of Environmental Sciences, 19(2):187-199.

Abbaszadeh, M. M., Vatandoust, S., Manoocheri, H., Mostafavi, H. and Hoseinifar, S. M. 2019. Analyzing habitat preferences of *Capoeta razii* (Teleostei: Cyprinidae) at different ages in the Zarem stream, Iran. Iranian Journal of Ichthyology, 6(4):302-308.

Abbaszadeh, M. M., Vatandoust, S., Manoocheri, H., Mostafavi, H. and Hoseinifar, S. M. 2021. Study of habitat preference of Kura fish (*Barbus lacerta*; Heckel, 1843) in Zaremrud River (from Tajan River branches) Mazandaran Province, Iran. Journal of Applied Ichthyological Research, 8(4):15-23. In Farsi.

Abd, I. M., Rubec, C. and Coad, B. W. 2009. Key biodiversity areas - Rapid assessment of fish fauna in southern Iraq, pp. 161-171. In: Krupp, F., Musselman, J. L., Kotb, M. M. A. and Weidig, I. (Eds.). Environment, Biodiversity and Conservation in the Middle East, Proceedings of the First Middle Eastern Biodiversity Congress, Aqaba, Jordan, 20-23 October 2008. BioRisk 3(Special Issue):219 pp. ISSN 1313-2652 (online), ISSN 1313-2644 (print). Pensoft Publishers, Sofia-Moscow (http://pensoftonline.net/biorisk/index.php/journal/article/view/15/27).

Abd Almaleki, Sh. and Ghaninezhad, D. 2007. Stock assessment of the Caspian Sea kutum (*Rutilus frisii kutum*) in Iranian coastal waters of the Caspian Sea. Iranian Scientific Fisheries Journal, 16(1):103-114. In Farsi.

Abdi, H., Mahmoudi, N. and Falahatkar, B. 2009. Effects of dietary nucleotide on some growth indices and proximate analysis of common carp (*Cyprinus carpio*). Journal of Marine Sciences and Technology, 8(1-2):22-30. In Farsi.

Abdi, I. and Alishahi, M. 2014. Comparison of organophosphorous pesticide, diazinon, toxicity in four native fish of Khouzestan province: *Barbus sharpeyi*, *Barbus grypus*, *Barbus xanthopterus* and *Barbus barbulus*. Journal of Utilization and Cultivation of Aquatics, 3(1):79-93. In Farsi.

Abdi, K. 1999a. Survey on the four new species of parasitic leeches of Mahabad's Lake Dam in Iran. In: 26th World Veterinary Congress, Lyon, France, 23-26 September 1999 (abstract).

Abdi, K. 1999b. Survey on the crustacean parasites of fishes of Mahabad's reservoir dam with new records of Tracheliastes polycolpus in Iran. In: 26th World Veterinary Congress, Lyon, France, 23-26 September 1999 (abstract).

Abdi, K., Jalalai, B., Moobedi, I. and Naem, S. 1995. Identification of crustacean parasites in Mahabad Reservoir. Pajouhesh va Sazandegi, 36:128-132. In Farsi.

Abdi, R. and Yasi, M. 2015. Evaluation of environmental flow requirements using eco-

hydrologic-hydraulic methods in perennial rivers. Water Science and Technology, 72(3):354-363.

Abdolhahi, M. 2015. Identification and study of fish's fauna in the Shor River at the Lali City. The 2nd National Conference on Environmental Hazards of Zagros, 5 March 2015, Tehran. 8 pp. In Farsi.

Abdolhay, H. A. 2011. Study of kutum (*Rutilus frisii kutum*) population using mtDNA with PCR. Iranian Fisheries Science Research Institute, Tehran. 70 pp. In Farsi.

Abdolhay, H. A., Daud, S. K., Pourkazemi, M., Siraj, S. S., Rezvani, S., Mostafa, K. A. S. and Hosseinzadeh Sahafi, H. 2010. Morphometric studies of mahisefid (*Rutilus frisii kutum*, Kamensky, 1901) from selected rivers in the southern Caspian Sea. Iranian Journal of Fisheries Sciences, 9(1):1-18.

Abdolhay, H. A., Daud, S. K., Rezvani, S., Pourkazemi, M., Siraj, S. S., Laloei, F., Javanmard, A. and Hassanzadeh Saber, M. 2012. Population genetic structure of mahi sefid (*Rutilus frisii kutum*) in the South Caspian Sea: implications for fishery management. Iranian Journal of Animal Biosystematics, 8(1):15-26.

Abdolhay, H. A., Daud, S. K., Rezvani Gilkolahi, S., Pourkazemi, M., Siraj, S. S. and Abdul Satar, M. K. 2011. Fingerling production and stock enhancement of mahisefid (*Rutilus frisii kutum*) lessons for others in the south of Caspian Sea. Reviews in Fish Biology and Fisheries, 21(2):247-257.

Abdolhay, H. A., Daud, S. K., Rezvani Gilkolahi, S., Pourkazemi, M., Siraj, S. S. and Javanmard, A. 2012. Genetic diversity of mahisefid (*Rutilus frisii kutum* Kamensky 1901) in different rivers of the south Caspian Sea using PCR-RFLP. Iranian Journal of Fisheries Sciences, 11(2):235-251, I.

Abdoli, A. 1992. A new fish species in Mazandaran ab bandans. Abzeeyan, Tehran, 2(8):54-55. In Farsi.

Abdoli, A. 1993. Fishes of Golestan National Park's river. Abzeeyan, Tehran, 4(3):32-33, XIII. In Farsi.

Abdoli, A. 1994. Ecological study of fish populations in Sardabrud River and Chalus River, Mazandaran, Iran. M.Sc. Thesis, University of Tehran. iv + 94 pp, 28 figs, 20 tables.

Abdoli, A. 1998a. An investigation of some biological characteristics and distribution of *Pseudorasbora parva* in freshwaters of Iran. Journal of Agricultural Sciences and Natural Resources, 8(1):33-40. In Farsi.

Abdoli, A. 1998b. Fish species status in southern Caspian Sea. First International Student Seminar of Coastal University of the Caspian Sea, Astrakhan, Russia (title).

Abdoli, A. 2000. The Inland Water Fishes of Iran. Iranian Museum of Nature and Wildlife, Tehran. 378 pp. In Farsi.

Abdoli, A. 2016. The Field Guide of the Inland Water Fishes of Iran. IranShenasi, Tehran. 272 pp. In Farsi.

Abdoli, A. 2021. Threats of Tilapia and other invasive fish species to the aquatic ecosystems of Iran. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Abdoli, A., Kiabi, B., Mostafavi, H., Mousavi, B., Ahmadzadeh, F., Rasooli, P., Delshab, H. and Moradi, A. 2010. Atlas of the wildlife (vertebrates) of Bushehr Province, Iran. Environmental Sciences Research Institute, Shahid Beheshti University and Department of the Environment of Bushehr Province, Ma'aref Publications. 227 pp. In Farsi.

Abdoli, A., Kiabi, B., Patimar, R. and Allahyari, S. 2008. Study of species diversity of fishes of Gomishan wetland in south east of Caspian Sea. International Conference on Biodiversity Conservation and Management, University of Science and Technology, Cochin, Kerala, India, 3-6 February 2008 (abstract).

Abdoli, A. and Mostafavi, H. 2009. Preliminary investigation of some biological characteristics of *Capoeta damascina* in Daleki and Shahpour rivers, Boushehr Province, southern Iran. Research Project, Institute of Environmental Sciences, Shahid Beheshti University, Tehran, 57 pp.

Abdoli, A. and Naderi, M. 2009. Biodiversity of Fishes of the Southern Basin of the Caspian Sea. Abzian Scientific Publications, Tehran. 243 pp. In Farsi.

Abdoli, A., Naderi, M., Foroughifard, H. and Kiabi, B. H. 2014. Fish diversity and distribution in two protected rivers, Sardabrud and Chalus, southern Caspian Sea basin, Iran. Iranian Journal of Ichthyology, 1(2):91-95.

Abdoli, A., Patimar, R. Mostafavi, H., Kiabi, B. H. and Rasooli, P. 2007. Feasibility of Le Cren Method for population estimation of freshwater fish in Iran. Fish Stock Assessment Methods for Lakes and Reservoirs: Towards the True Picture of Fish Stock, 11-15 September 2007, Ceske Budejovice, Czech Republic (poster).

Abdoli, A., Rasooli, P. and Mostafavi, H. 2008. Length-weight relationships of *Capoeta capoeta capoeta* (Gueldenstaedt, 1772) in the Gorganrud River, south Caspian basin. Journal of Applied Ichthyology, 24(1):96-98.

Abdoli, A., Rasooli, P. and Soltaninasab, S. 2008. A contribution to the biology of *Acanthalburnus urmianus* (Günther, 1899) (Osteichthyes: Cyprinidae): an endemic fish of Iran. Zoology in the Middle East, 43(1):111-112.

Abdoli, A., Rasooli, P., Yazdandad Bibalan, H. and Abdoli, L. 2007. A study on some ecological aspects of snow trout (*Schizothorax pelzami*) from Laiinsoo River in northeastern Iran. Environmental Sciences, 4(3):69-76.

Abdoli, A., Sayadrahim, M., Mohammadidost, R., Hoseinjani, A., Zolfinezhad, K. and Ramzani, M. 2017. Study on distribution of fish species in Anzali Wetland and its rivers. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, abstract and pp. 642-648. In Farsi.

Abdoli, A. and Skandari, S. K. 1999. Reproductive biology of khramulya (*Capoeta capoeta gracilis*) in Madarso stream in Golestan National Park. Journal of Agricultural Sciences and Natural Resources, 6(3):38-51. In Farsi.

Abdollahi, M. and Imanpur, M. R. 2014. Effect of reproductive migration time on some biological character of eggs in mahisefid (*Rutilus frisii kutum* Kamenskii 1901). Journal of Animal Researches (Iranian Journal of Biology), 27(1):80-88. In Farsi.

Abdollahi, S., Khodadadi, M., Peyghan, R. and Rajabzadeh, E. 2010. Investigating relationship between silver carp mortality and some environmental factors in fish culture ponds of Azadegan farming complex. Journal of Marine Science and Technology Research, 5(1):47-60. In Farsi.

Abdollahi, Z., Kavian, A., Sadeghi, S. H. R., Khosrovyan, A. and DelValls, A. 2019. Identifying environmental risk associated with anthropogenic activities in Zanjanrud River, Iran, using an integrated approach. Catena, 183:104156.

Abdollahpour, Z., Rahmani, H. and Hasani, M. 2015. The study effect of diazinon on serumic factors in *Cyprinus carpio* in presence of Azolla. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 114.

Abdollahzadeh, F., Khayatzadeh, J. and Ghasemzadeh, F. 2018. Comparing study of the effects of copper nanoparticles and copper sulphate on gill histopathology and growth rate of grass carp (*Ctenopharyngodon idella*). Iranian Scientific Fisheries Journal, 27(2):81-90. In Farsi.

Abdolmalaki, Sh. 2000. Survey of parasites of fishes of Makoo Reservoir. Department of Fisheries and Sciences, Iran. 21 pp. In Farsi.

Abdolmalaki, Sh. 2004. Fishery status and stock assessment of silver carp (*Hypophthalmichthys molitrix*) in Mahabad Reservoir in fishing season of 1998-1999. Iranian Scientific Fisheries Journal, 13(1):77-96. In Farsi.

Abdolmalaki, Sh. 2005. Population dynamics of Caspian Sea bream (*Abramis brama orientalis*) in Iranian coast of the Caspian Sea in 2000-2001. Pajouhesh va Sazandegi, 18(3)(68):85-92. In Farsi.

Abdolmalaki, Sh. 2006a. Stock assessment of bonyfishes in the Iranian coastal water of the Caspian Sea. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bandar Anzali. 155 pp. In Farsi.

Abdolmalaki, Sh. 2006b. Trends in stock fluctuations of *Rutilus frisii kutum* in the Caspian Sea. Iranian Scientific Fisheries Journal, 15(2):87-100. In Farsi.

Abdolmalaki, Sh. 2014. The study on fishing and resource management of bony fisheries within southern Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 117 pp. In Farsi.

Abdolmalaki, Sh. and Ghaninezhad, D. 2005. Report on stock assessment and composition of the commercial bony fishes in the southern Caspian Sea. Fisheries Research Institute, Bandar Anzali. 132 pp.

Abdolmalaki, Sh. and Ghaninezhad, D. 2007a. Stock assessment of the Caspian kutum *Rutilus frisii kutum* in the Iranian coastal waters of the Caspian. Sea. Iranian Scientific Fisheries Journal, 16(1):103-114.

Abdolmalaki, Sh. and Ghaninezhad, D. 2007b. Releasing fry of kutum (*Rutilus frisii kutum*) for restocking in Iranian waters of the Caspian Sea. Abzeeyan, 36:8-13. In Farsi.

Abdolmalaki, Sh., Mirzajani, A. R., Khodaparast, S. H., Ghaninejad, D., Abbasi Ranjbar, K., Khedmati, K., Nikpour, M., Tavakoli, M. and Khoshghalb, M. R. 2017. Presence of Caspian Sea kutum (*Rutilus kutum*) in Khandaghlo dam Reservoir in Zanjan Province in 2011. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Abdolmalaki, Sh., Sadat, H. A. and Nahrevar, R. 2007. Catch status and population structure of kutum (*Rutilus frisii kutum*) in Iranian coastal water of the Caspian Sea. Journal of Marine Sciences and Technology, 6(3-4):51-62. In Farsi.

Abdolmaleki, S. 1994. An investigation on the benthic macrofauna of the Anzali Lagoon. Iranian Scientific Fisheries Journal, 2(4):27-38, 4. In Farsi.

Abdullah, A. H. J. 2016. Descriptive and comparative osteology of five cyprinid fishes from southern Iraq. Mesopotamian Journal of Marine Science, 31(2):159-168.

Abdullah, M. O. and Mohamed, A-R. M. 2019. The occurrence, growth, reproduction and food habit of *Carasobarbus luteus* in the Al-Diwaniya River, middle of Iraq. Muthanna Journal of Agriculture Science, 7(2):15 pp. In Arabic.

Abdurakhmanov, Yu. A. 1962. Ryby Presnykh vod Azerbaidzhana [Freshwater Fishes of Azerbaidzhan]. Akademii Nauk Azerbaidzhanskoi SSR, Institut Zoologii, Baku. 407 pp.

Abdurakhmanov, Yu. A. 1975. Transformation of the diadromous Kura shemaya *Chalcalburnus chalcoides* into a land-locked population in the Mingechaur Reservoir. Journal of Ichthyology, 15(2):189-196.

Abdurakhmanov, Yu. A., Kuliev, Z. M. and Agayarova, A. E. 1968. Materialy po Biologii i Raspredeleniyu Ryb u Azerbaidzhanskogo Poberezh'ya Srednego i Yuzhnogo Kaspiya [Materials on the biology and distribution of fishes at the Azerbaidzhan coast of the Central and Southern Caspian]. In: The Biology of the Central and Southern Caspian. Moscow. pp. 113-146.

Abdurrahmanov, Y. A. 1966. Azarbaycanin Faunasi. VII Cild. Baliglar (Pisces). [The Fauna of Azerbaidzhan. VII. Fishes (Pisces)]. Zoologiya Institutu, Azarbaycan SSR Elmlar Akademiyasi, Baki. 224 pp. In Azerbaijani.

Abdusamadov, A. S. 1986. Biology of white amur, *Ctenopharyngodon idella*, silver carp, *Hypophthalmichthys molitrix*, and bighead, *Aristichthys nobilis*, acclimatized in the Terek region of the Caspian basin. Journal of Ichthyology, 26(4):41-49.

Abdy, E., Alishahi, M., Tabandeh, M. R., Ghorbanpoor, M. and Jafari, H. 2016. Comparative effect of Freund's adjuvant and *Aloe vera* L. gel on the expression of TNF-α and IL-1β in vaccinated *Cyprinus carpio* L. with *Aeromonas hydrophila* C. bacterin. Aquaculture Research, 47(8):2543-2552.

Abedi, M. 2003. Examining the possibility of multiplication and breeding of (*Schizothorav* (*sic*) *zarudnyi*) in order to restoration of regional aquatic reservations of Hamoon Lake and taking its advantag (*sic*) for aquaculture. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 235 pp. In Farsi.

Abedi, M., Benam, S., Shahbazi Naserabad, S. and Saffarshargh, A. 2016. Histopathology of the spleen affected by different DO (dissolved oxygen) levels in two weight-groups of the common carp (*Cyprinus carpio*). The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abedi, M., Eagderi, S., Ghafari Farsani, H., Shahbazi Naserabad, S. and Benam, S. 2016. Morphological flexibility of pearl Zagros fish (*Alburnus zagrosensis*, Code (*sic*), 2009) at Choghakhor wetland, Cheshmeh Ali and Hamzeh Ali areas, Charmahal Bakhtiari Province, Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abedi, M., Shiva, A. H., Mohammadi, H. and Malekpour, R. 2010. Reproductive biology and age determination of *Garra rufa* Heckel, 1843 (Actinopterygii: Cyprinidae) in central Iran. Turkish Journal of Zoology, 35(3):317-323.

Abedi, S. and Tahami Pour Zarandi, M. 2021. Investigating the effectiveness of policy tools and regulations in protecting wetlands and lakes with an executive approach in Iran. Journal of Wetland Ecobiology, 12(1):113-136. In Farsi.

Abedi, S. Z., Khalesi, M. K., Eskandari, S. K. and Behrouzi, Sh. 2016. Histopathological effects of chromium on gill tissue of common carp. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abedi, Z., Hasantabar, F., Khalesi, M. K. and Babaei, S. 2013a. Effect of sublethal concentrations of cadmium, lead and chromium on some enzymatic activities of common carp; *Cyprinus carpio*. World Journal of Zoology, 8(1):98-105.

Abedi, Z., Hasantabar, F., Khalesi, M. K. and Babaei, S. 2013b. Enzymatic activities in common carp; *Cyprinus carpio* influenced by sublethal concentrations of cadmium, lead, chromium. World Journal of Fish and Marine Sciences, 5(2):144-151.

Abedi, Z., Khalesi, M. K. and Eskandari, S. K. 2012. A comparative study on chromium absorption between scaled and scaleless fish species: common carp (*Cyprinus carpio*) and sutchi (striped) catfish (*Pangasius hypophthalmus*). Journal of Experimental Animal Biology, 1(3):25-32. In Farsi.

Abedi, Z., Khalesi, M. K., Firouzbakhsh, F., Behrouzi, S. and Mohammadzadeh, S. 2012. First report of epidermal inclusion cyst in *Cyprinus carpio*. World Journal of Fish and Marine Sciences, 4(5):467-469.

Abedi, Z., Khalesi, M. K. and Kohestan Eskandari, S. 2013. Biochemical and hematological profiles of common carp (*Cyprinus carpio*) under sublethal effects of trivalent chromium. Iranian Journal of Toxicology, 7(20):782-792.

Abedi, Z., Khalesi, M. K., Kohestan Eskandari, S. and Rahmani, H. 2012. Comparison of lethal concentrations (LC_{50}-96 H) of $CdCl_2$, $CrCl_3$, and $Pb(NO_3)_2$ in common carp (*Cyprinus carpio*) and sutchi catfish (*Pangasius hypophthalmus*). Iranian Journal of Toxicology, 6(18):672-680.

Abedi, Z., Khalesi, M. K. and Kouhestan Eskandari, S. 2013. Comparison of cadmium absorption between scaled and scaleless fish species: common carp (*Cyprinus carpio*) and sutchi (striped) catfish (*Pangasius hypophthalmus*). Journal of Animal Biology, 5(2):35-46. In Farsi.

Abedi, Z., Rahmani, H., Khalesi, M. K. and Khara, H. 2012. A comparative study on some biological parameters in broodstock and juvenile kutum, *Rutilus kutum* in the southern Caspian Sea basin. Journal of Environmental Sciences, 10(2):205-213.

Abedini, A. 2017. The study of some trophic index in Anzali lagoon. Iranian Fisheries Science Research Institute, Tehran. 40 pp. In Farsi.

Abedini, A., Bagheri, S. and Khodaparast, H. 2016. Trophic index of fish habitat in the Chitgar Lake. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Abedini, A., Bagheri, S., Mirzajani, A. R., Ghane, A. and Talakesh, M. R. 2022. The trend of changes in the Trophic State Index (TSI) in Chitgar Lake during 2013-2019. Journal of Wetland Ecobiology, 13(1):in press. In Farsi.

Abedini, A., Bagheri, S., Moradi, M., Khodaparast, H. and Imani, O. 2017. Water quality and fish status in Chitgar Lake. Breeding and Aquaculture Sciences Quarterly, 4(13):61-74. In Farsi.

Abedini, A., Bagheri, S., Shonddasht, J., Bayat, J. and Mohsenpoor, H. 2018. The hydrochemical study of Chitgar Lake. Iranian Fisheries Science Research Institute, Tehran. 39 pp. In Farsi.

Abedini, A., Mirzajani, A. R. and Fallahi, M. 2018. Physicochemical conditions and trophic levels of the Anzali Wetland. Iranian Scientific Fisheries Journal, 26(6):113-123. In Farsi.

Abell, R., Thieme, M. L., Revenga, C., Bryer, M., Kottelat, M., Bogutskaya, N., Coad, B., Mandrak, N., Contreras Balderas, S., Bussing, W., Stiassny, M. L. J., Skelton, P., Allen, G. R., Unmack, P., Naseka, A., Ng, R., Sindorf, N., Robertson, J., Armijo, E., Higgins, J. V., Heibel, T. J., Wikramanayake, E., Olson, D., López, H. L., Reis, R. E., Lundberg, J. G., Sabaj Pérez, M. H. and Petry, P. 2008. Freshwater Ecoregions of the World: A new map of biogeographic units for freshwater biodiversity conservation. BioScience, 58(5):403-413.

Abich, H. 1856. Vergleichende Chemische Untersuchungen der Wasser des Caspischen Meeres,

Urmia- und Van-See's. Mémoires de l'Académie Impériale des sciences de Saint-Pétersbourg, sixième série, Sciences mathématiques et physiques, 7:57 pp., 2 plates.

Abolfathi, M., Hajimoradloo, A., Ghorbani, R. and Zamani, A. 2012. Compensatory growth in juvenile roach *Rutilus caspicus*: effect of starvation and re-feeding on growth and digestive surface area. Journal of Fish Biology, 81(6):1880-1890.

Abolghasemi, S. J. and Taati, R. 2021. The role of cultured chironomid larvae (*Chironomus albidus*) in bioremediation of wastewater of common carp (*Cyprinus carpio*) rearing tanks. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Abolhasani, M. H., Pirestani, N. and Ghasemi, S. 2018. Assessment of the primary production statues of the international Gavkhooni Wetland, Iran. International Journal of Aquatic Biology, 6(5):248-253.

Abolhasani, M. H., Pirestani, N. and Ghasemi, S. 2019. Effects of nutrients on the primary production and determination of the restricting factors in primary production in the international wetland of Choghakhor (Iran). Journal of Advances in Environmental Health Research, 7(2):94-100.

Abood, A. N. and Mohamed, A-R. M. 2020. Population dynamics of an invasive species *Carassius auratus* in the Shatt Al-Arab River, Iraq. Archives of Agriculture and Environmental Science, 5(3):384-389.

Abou, M., Saeedi, A. A., Rezai, A., Rezvani, Z. and Mirhashemi, S. F. 2005. Biological control of intermediate host parasites (snails) by the use of *Tinca tinca* fish. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', September 8-10, Shahr-e Kord, Iran (abstract).

Abouei, E., Jafarpour, A. and Motamed, Z. 2015. Effects of microbial transglutaminase (MTGase) on functional and rheological properties of big head (*Hypophtalmichthys nobilis*) (*sic*) fish skin gelatin. Iranian Journal of Food Science and Technology, 13(58):93-106. In Farsi.

Abrishamchi, A. and Tajrishy, M. 2005. Interbasin water transfers in Iran, pp. 252-271. In: Water Conservation, Reuse, and Recycling. Proceedings of an Iranian-American Workshop (2005), The National Academies Press, Washington, D.C., 292 pp.

Abtahi B., Esmaili Sari, A., Khodabandeh, S. and Seifabadi J. 2001. Ctenophores of the Caspian Sea and their socio-economic impacts. The Second International Iran and Russia Conference (Agriculture & Natural Resources), Moscow. Abstract, p. 164.

Abtahi, B., Faghiehzadeh, S., Omidbeigi, R., Shariefpour, A., Rassoli, A., Nazari, R. M. and Aghajanpour, M. 2002. The comparison of LC50 of clove essence and MS222 in *Acipenser persicus*, *Oncorhynchus mykiss* and *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 11(3):1-12. In Farsi.

Abtahi, M., Shahriari Moghadam, M., Rezaei, S. and Abbasi, H. 2014. Larval organogenesis of *Schizothorax zarudnyi* (Nikolskii, 1897) (Cyprinidae): Histological aspects. Journal of Fisheries Sciences, 8(2):121-130.

Abulhani, A. J. and Al-Rudainy, A. J. 2000. Age and growth of gattan *Barbus xanthopterus* (Heckel) in Al-Qadisia Dam Lake. Scientific Journal of the Iraqi Atomic Energy Commission, 2:124-132. In Arabic.

Abuzyarov, Z. K. 1999. Problems of the Caspian Sea level predictions. TACIS (Technical Assistance to the Commonwealth of Independent States, European Union), Caspian Environment Programme, Baku, Azerbaijan. 17 pp.

Abzigostar. 1996. Iran fisheries sector study. Report by Abzigostar Consulting Engineering Company to Shilat, Tehran. 190 pp.
Abzigostar. 2004a. Report on fisheries activity in Zarivar Lake. Report by Abzigostar Consulting Engineering Company to Fisheries General Directorate, Kurdistan Province. 68 pp.
Abzigostar. 2004b. Report on environment in Zarivar Lake. Report by Abzigostar Consulting Engineering Company to Fisheries General Directorate, Kurdistan Province. 95 pp.
Abzigostar. 2004c. Report on limnology in Zarivar Lake. Report by Abzigostar Consulting Engineering Company to Fisheries General Directorate, Kurdistan Province. 100 pp.
Adamicka, P. 1984. On the construction of the Pontic cyprinid *Pelecus cultratus* (L.). Archiv für Hydrobiologie, 101(1/2):9-19.
Adams, C. G., Bayliss, D. D. and Whittaker, J. E. 1999. The terminal Tethyan event: A critical review of the conflicting age determinations for the disconnection of the Mediterranean from the Indian Ocean, pp. 477-484. In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.
Adams, R. M. 1962. Agriculture and urban life in early southwestern Iran. Science, 136(3511):109-122.
Adel, M., Abedian Amiri, A., Zorriehzahra, J., Nematolahi, A. and Esteban, M. A. 2015. Effects of dietary peppermint (*Mentha piperita*) on growth performance, chemical body composition and hematological and immune parameters of fry Caspian white fish (*Rutilus frisii kutum*). Fish and Shellfish Immunology, 45(2):841-847.
Adel, M., Ghasempour, F., Azizi, H. R., Shateri, M. H. and Safian, A. R. 2015. Survey of parasitic fauna of different ornamental freshwater fish species in Iran. Veterinary Research Forum, 6(1):75-78.
Adel, M., Riyahi Cholicheh, H., Gholamhosseini, A., Bigham Sadegh, A. and Zorriehzahra, M. 2020. A comparison between sedation using propofol and clove oil in Levantine scraper (*Capoeta damascina*). Iranian Journal of Fisheries Sciences, 19(6):2893-2900.
Adel, M., Safari, R., Monji, H. and Vahid Farabi, S. M. 2015. The effect of different levels of *Mentha piperita* on growth performance, survival rate and body composition of *Rutilus frisii kutum* fry. Journal of Aquatic Ecology, Hormozgan University, 5(1):95-102. In Farsi.
Adeli, A. 2013. Evaluation and interpretation of policies of five-year developmental plans and Iran fisheries outlook. Journal of Fisheries Science and Technology, 2(3):57-74. In Farsi.
Adeli, A. 2014a. A study of some situational factors on home consuming behavior of fishes in Tehran. Journal of Fisheries, 67(2):251-261. In Farsi.
Adeli, A. 2014b. Fee-fishing development and management. Journal of Utilization and Cultivation of Aquatics, 3(3):37-52. In Farsi.
Adeli, A., Alidoosti, K., Kordjazi, M., Vahedi, M. and Erabi, H. 2020. Evaluating the mixed marketing factor of Tehran big fish market from the sellers' viewpoint. Journal of Aquaculture Development, 14(3):55-69. In Farsi.
Adeli, A., Baei, H. and Pendar, M. 2020. Determining and ranking the influencing factors on fishery products export in Iran. Iranian Scientific Fisheries Journal, 29(1):13-25. In Farsi.
Adeli, A. and Baghaei, F. 2016. Status of production and market of fishmeal on the aquaculture development. Journal of Aquaculture Development, 10(3):137-149. In Farsi.
Adeli, A., Ghafari, T., Ojagh, S. M. and Vahedi, M. 2019. An evaluating of factors affecting on

purchase and sale trends in fish markets in ports of Guilan Province. Iranian Scientific Fisheries Journal, 28(3):55-65. In Farsi.
Adeli, A., Hasangholipour, T., Hossaini, S. A., Salehi, H. and Shabanpour, B. 2010a. Tehranish household preference for farmed fish consumption. Research Journal of Fisheries and Hydrobiology, 5(2):129-136.
Adeli, A., Hasangholipour, T., Hossaini, S. A., Salehi, H. and Shabanpour, B. 2010b. Identifying the main factors affecting home consumption attitude to farmed fishes among Tehrani households. Iranian Scientific Fisheries Journal, 19(3):87-96. In Farsi.
Adeli, A., Hasangholipour, T., Hossaini, S. A., Salehi, H. and Shabanpour, B. 2011. Status of fish consumption per capita of Tehran citizens. Iranian Journal of Fisheries Sciences, 10(4):546-556, I.
Adeli, A. and Mirbagheri, V. S. 2018. Estimation of awareness of fisheries students with regarding to benefits of fish consumption. Iranian Scientific Fisheries Journal, 27(6):79-91. In Farsi.
Adeli, A. and Namdar, M. 2015. The Iranian caviar and its substitutes in the world market. Ecopersia, 3(1):933-944.
Adeli, A. and Shaabanpour, B. 2007. Study on Tehran citizen’s behaviour change in consumption of the aquatic products. Iranian Scientific Fisheries Journal, 16(2):117-126. In Farsi.
Adeli, M., Ghelichi, A., Ahmadi, Z. and Kamali Sanzighi, M. 2016. Effect of different feeding frequency on feed consumption, growth and feed conversion ratio of common carp fingerlings (*Cyprinus carpio* Linnaeus, 1758). New Technologies in Aquaculture Development (Journal of Fisheries), 10(1):55-60. In Farsi.
Adeli, M., Maleki, S., Ghelichi, A., Amiri, S. and Adeli, Z. 2018. Effects of starvation period and compensatory growth on growth indices and body composition in fingerling common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(4):301-308. In Farsi.
Adeli Mosabbab, Y. and Piri, Kh. 2005. Monitoring of release rnies (*sic*) of juvenile vobla (*Rutilus rutilus*) at the Iranian coast of the Caspian Sea with the purpose of restoring of its stocks, p. 15. In: Proceedings XIII International Conference on Fisheries Oceanology, Svetlogorsk, Kanliningrad region, September 12-17, 2005.
Adelian, M., Imanpoor, M. R. and Jafari, V. 2019a. Effects of combo multi enzyme in the diet on growth factors, survival rate and reproductive performance of gold fish (*Carassius auratus gibelio*). Journal of Animal Environment, 11(1):273-282. In Farsi.
Adelian, M., Imanpoor, M. R. and Jafari, V. 2019b. Effects of natuzyme multi enzyme in the diet on growth factors, survival rate and reproductive performance of gold fish (*Carassius auratus gibelio*). Journal of Animal Environment, 11(2):215-224. In Farsi.
Adelian, M., Imanpoor, M. R., Taghizadeh, V. and Mazandarani, M. 2016a. Utilizing kemin multi-enzymes in the diet and their effects on growth and some blood factors of common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(1):201-206. In Farsi.
Adelian, M., Imanpoor, M. R., Taghizadeh, V. and Mazandarani, M. 2016b. Utilizing natuzyme multi-enzyme in the diet and their effects on growth and some blood biochemical factors of common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(2):207-214. In Farsi.
Adib, A., Oulapour, M. and Chatroze, A. 2018. Effects of wind velocity and soil characteristics on dust storm generation in Hawr-al-Azim Wetland, Southwest Iran. Caspian Journal of Environmental Sciences, 16(4):333-347.

Adibmoradi, M. and Sheibani, M. T. 2002. The histological study of mesencephal and cerebellum in *Rutilus frisii kutum*. Journal of the Faculty of Veterinary Medicine, University of Tehran, 57(2):15-18. In Farsi.

Adineh, H., Harsij, M. and Nazer, A. 2018. Effects of *Yucca schidigera* extract on the growth performance, feed efficiency, body composition of common carp (*Cyprinus carpio*, Linnaeus, 1758) and culture water quality. Iranian Scientific Fisheries Journal, 27(3):11-21. In Farsi.

Adler, K. 1989. Contributions to the History of Herpetology. Society for the Study of Amphibians and Reptiles, Contributions to Herpetology, Oxford, Ohio, 5:1-202.

Admiralty Naval Staff. 1918. Geology of Mesopotamia and its borderlands. Intelligence Department, Admiralty Naval Staff, HMSO, London (I. D. 1177). 116 pp.

Afham, A. and Falsafian, A. 2017. Identification of price and non-price factors affecting willingness to consume fish among households of Urmia City: application of ordered logit model. Agricultural Economics, 11(3):55-79. In Farsi.

Afifi, H. 1966. A summary of method analysis used in the Zayandeh Rud river discharge study, pp. 213-226. In: Symposium on Hydrology and Water Resources Development held in Ankara, Turkey February 7 to 12, 1966, Central Treaty Organization, Ankara. 484 pp.

Afkhami, A. A. 1998. Disease and water supply: the case of cholera in 19th century Iran. Yale School of Forestry & Environment Studies Bulletin, 103:206-220.

Afkhami, M., Bastami, K. D., Shabani, N. and Soltani, F. 2011. A survey on ionic and metabolite factors of blood serum in kutum (*Rutilus frisii kutum*). Proceedings of the 3rd Aquatic Biodiversity International Conference, Sibiu/Transylvania, p. 98 (abstract).

Afkhami, M., Bastami, K. D., Shabani, N. and Soltani, F. 2014. A survey on ionic and metabolite factors of blood serum in kutum (*Rutilus frisii kutum*). Transylvanian Review of Systematical and Ecological Research, 16(2):127132.

Afkhami, M., Mokhlesi, A., Bastami, K. D., Khoshnood, R., Eshaghi, N. and Ehsanpour, M. 2011. Survey of some chemical compositions and fatty acids in cultured common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*), Noshahr, Iran. World Journal of Fish and Marine Sciences, 3(6):533-538.

Afkhami, M., Mokhlesi, A., Bastami, K. D., Khoshnood, R., Eshaghi, N., Ehsanpour, M., Khazaali, A. and Soltani, F. 2011. Survey of some chemical compositions and fatty acids in cultured common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*), Noshahr, Iran. Proceedings of the 3rd Aquatic Biodiversity International Conference, Sibiu/Transylvania, p. 47 (abstract).

Afkhami, M., Shariat, M., Jaafarzadeh, N., Ghadiri, H. and Nabizadeh, R. 2007. Regional water quality management for the Karun-Dez River basin, Iran. Water and Environment Journal, 21(3):192-199.

Afraei, M. and Lalooie, F. 2000. Fishes distribution assay in Tonekabon River. Iranian Scientific Fisheries Journal, 9(1):1-14, 1. In Farsi.

Afraei Bandpei, M. A. 2009. Age, growth, feeding regime reproduction and sexual maturity of *Rutilus frisii kutum* in Iranian coastal waters of Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 58 pp. In Farsi.

Afraei Bandpei, M. A. 2010. Population dynamics of kutum, *Rutilus frisii kutum* in the Caspian Sea. Ph.D. Thesis, University Sains Malaysia. 243 pp.

Afraei Bandpei, M. A. 2014. The roles of bony fish catch with emphasis on kutum, *Rutilus frisii kutum* in fishermen’s income in fishing season 2008-09 from the southern Caspian Sea.

Journal of Novel Applied Sciences, 3(2):194-202.
Afraei Bandpei, M. A., Abdolmaleki, S., Kymaram, F., Ghasemi, S., Parafkande, F., Janbaz, A., Kor, D., Daryanabard, G., Taleshian, H. and Larijani, M. 2007. Age, growth, feeding regime, and reproduction of kutum (*Rutilus frisii kutum*) in the south of the Caspian Sea in survey, 2006-2007. Final Report, Iranian Fisheries Research Organization, Tehran. 97 pp. In Farsi.
Afraei Bandpei, M. A., Fazli, H. and Shahlapour, Sh. 2018. Identification and species diversity of fishes in Gorgan Bay. Iranian Scientific Fisheries Journal, 27(2):61-69. In Farsi.
Afraei Bandpei, M. A., Hashemian, A. and Parafkandeh, F. 2016. Structure of macrobenthic invertebrate population in the southern coast of Caspian Sea for fish cage culture establishment. Iranian Scientific Fisheries Journal, 25(5):23-40. In Farsi.
Afraei Bandpei, M. A., Mashhor, M., Abdolmalaki, S. and El-Sayed, M. A.-F. 2009. Food and feeding habits of the Caspian kutum, *Rutilus frisii kutum* (Cyprinidae) in Iranian waters of the Caspian Sea. Cybium, 33(3):193-198.
Afraei Bandpei, M. A., Mashhor, M., Abdolmalaki, S. and El-Sayed, A.-F. M. 2010. Population dynamics of Caspian kutum, *Rutilus frisii kutum* (Cyprinidae) in southern Caspian Sea, Iran. Cybium, 34(3):285-292.
Afraei Bandpei, M. A., Mashhor, M., Abdolmalaki, S., Keymaram, S., Isa, M. M. and Janbaz, A. A. 2010. Age and growth of kutum (*Rutilus frisii kutum*, Kamensky, 1901) in southern Caspian Sea. International Aquatic Research, 2(1):25-33.
Afraei Bandpei, M. A., Mashhor, M., Abdolmaleki, S. H., Najafpour, S. H., Bani, A., Pourgholam, R., Fazli, H., Nasrolahzadeh, H. and Janbaz, A. A. 2011. The environmental effect on spawning time, length at maturity and fecundity of kutum (*Rutilus frisii kutum*, Kamensky, 1901) in southern part of Caspian Sea, Iran. Iranica Journal of Energy and Environment, 2(4):374-381.
Afraei Bandpei, M. A., Mashhor, M., Khoo, K. H., Abdolmalaki, S., Fazli, H. and Janbaz, A. A. 2008. Some biological characteristics of the Caspian kutum, *Rutilus frisii kutum* (Cyprinidae) of the southern Caspian Sea. International Conference on Environmental Research and Technology (ICERT 2008), Penang, Malaysia, 28 to 30 May 2008, pp. 494-497.
Afraei Bandpei, M. A., Naderi, M., Nasrolahzade Saravi, H., Shakori, M. and Rahmati, R. 2019. Feeding habits and some biological aspects of *Capoeta saadii* (Heckel, 1874) (*sic*) in the Sanandaj Azad dam. Scinzer Journal of Agricultural and Biological Sciences, 4(1):1-7.
Afraei Bandpei, M. A., Naderi, M., Nasrolahzadeh, H., Khodaparast, N., Hoseinpour, H. and Fazli, H. 2017. Food and feeding habits of the Mossul bleak, *Alburnus mossulensis* Heckel, 1843 (Cyprinidae) in the Azad dam of Sanandaj, Iran. International Journal of Farming and Allied Sciences, 6(5):126-134.
Afraei Bandpei, M. A., Nasrollahzadeh Saravi, H., Ramin, M., Bagheri, S. and Esmaili, R. 2018. The survey of distribution and species diversity in the Haraz River. Journal of Aquatic Caspian Sea (Caspian Sea Fisheries Journal), 2(3):43-54. In Farsi.
Afraei Bandpei, M. A., Roohi, A., Nasrollahzadeh Saravi, H., Khodaparast, N., Daryanabard, R., Makhlogh, A., Tahami, F., Rowshantabari, M., Hashemian, A. and Keihansani, A. 2017. Relationship between biological parameters and fish catch ratio of *Rutilus kutum* Kamensky, 1901 and *Cyprinus carpio* in the southeast of the Caspian Sea (Mazandaran-Goharbaran). Ecology and Evolutionary Biology, 2(1):1-13.
Afraei Bandpei, M. A., Solaimani Roudi, A. and Janbaz, A. A. 2013. Feeding regime of kutum,

Rutilus frisii kutum (Kamensky 1901) at the various ages in the southern Caspian Sea (Mazandaran waters) in survey. Iranian Aquaculture Society Journal, 1(1):49-63. In Farsi.
Afrasiabi, K. L. 2003. The environmental movement in Iran: perspectives from below and above. Middle East Journal, 57(3):432-448.
Afraz, A. 1996. Classification of Anzali Lagoon rivers. Iranian Scientific Fisheries Journal, 5(1):1-17, 1. In Farsi.
Afsar Dir, S., Kashiri, H., Adineh, H., Boozarpour, S. and Hedayati, S. A. 2021. Effect of different levels of dietary magnesium nanoparticles on growth, digestive enzymes activity and immune factors of common carp (*Cyprinus carpio*) under glyphosate exposure. Journal of Applied Ichthyological Research, 8(3):73-82. In Farsi.
Afsari, N., Naghavi, S. N. and Nazari, A. 2014. Detection of human pathogenic gram negative bacteria from ornamental goldfish according to gene sequence alignment. Journal of Biological Sciences, 14(4):332-335.
Afshari, A., Sourinejad, I., Gharaei, A., Johari, S. A. and Ghasemi, Z. 2021. The effects of diet supplementation with inorganic and nanoparticulate iron and copper on growth performance, blood biochemical parameters, antioxidant response and immune function of snow trout *Schizothorax zarudnyi* (Nikolskii, 1897). Aquaculture, 539:736638.
Afshari, A., Sourinejad, I., Sheybak, H. and Arabnejad, S. 2016. Effect of salinity stress on the growth rate, biochemical parameters and cortisol level of the blood in Sistans's loach (*sic*) *Schizothorax zarudnyi* (Nikolskii, 1897). Journal of Applied Ichthyological Research, 4(3):43-52. In Farsi.
Afshariani, Z. and Alavi-Yeganeh, M. S. 2014. Surveying and classifying of ichthyological scientific data on internet. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Afsharimoghaddam, A., Khedri, J., Rahnama, M. and Hosseini, Z. 2016a. Contamination of *Ctenopharyngodon idella* with *Lernaea* in Chahnimeh, Zabol. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Afsharimoghaddam, A., Khedri, J., Rahnama, M. and Hosseini, Z. 2016b. A report on the contamination of ordinary *Ctenopharyngodon idella* with *Ligula* in Zabol. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Afshin, I. 1994. Rivers of Iran. Ministry of Energy of Iran Publications. 575 pp. In Farsi.
Aftabgard, M., Zamini, A. and Ershad Langaroudi, H. 2011. The effect of prebiotic "Immunoster" on growth indices, survival rate, density of blood cells and body composition of Caspian Sea sefid (*Rutilus frisii kutum*) fingerlings. Journal of Marine Sciences and Technology, 10(1):100-112. In Farsi.
Aftabgard, M., Zamini, A. A., Ershad Langaroudi, H. and Miralami, N. 2013. The study of immunoster prebiotic effects on biometric factors with emphasis on weight and length and differential specification of leukocytes in Caspian Sea *Rutilus kutum* fingerlings. Journal of Animal Researches (Iranian Journal of Biology), 26(3):245-254. In Farsi.
Agah, H., Leermakers, M., Elskens, M., Fatemi, S. M. R. and Baeyens, W. 2007. Total mercury and methyl mercury concentrations in fish from the Persian Gulf and the Caspian Sea. Water, Air, & Soil Pollution, 181(1-4):95-105.
Agh, N. 2016. How to save the dying Lake Urmia?, pp. 110-119. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.
Agh, N. H., Aladin, N. V., Gontar, V. I., Zhakova, L. V., Micklin, P. T., Plotnikov, I. S. and

Smurov, A.O. 2015. How to save Lake Urmia in Islamic Republic of Iran? (www.zin.ru/labs/brackish/presentations/How_to_save_Urmia_Lake_EN.pps, downloaded 15 September 2016).

AghaKouchak, A., Norouzi, H., Madani, K., Mirchi, A., Azarderakhsh, M., Nazemi, A., Nasrollahi, N., Farahmand, A., Mehran, A. and Hasanzadeh, E. 2014. Aral Sea syndrome desiccates Lake Urmia: call for action. Journal of Great Lakes Research, 41(1):307-311.

Aghamirkarimi, Sh., Masinchian Moradi, A., Sharifpour, I., Jamili, Sh. and Ghavam Mostafavi, P. 2018. Effect of copper nanoparticles in the Caspian roach (*Rutilus rutilus caspicus*), changing antioxidant activities and liver histopathology. Iranian Scientific Fisheries Journal, 27(5):125-134. In Farsi.

Aghasi, M., Mohaghegh, S. S., Bahrebar, A., Savari, A. and Ronagh, M. T. 2014. Qualitative and quantitative investigation of Dez River water from the reach of Dez Dam to meeting point of Karun using NSFWQI index. International Journal of Biosciences, 4(1):104-111.

Aghili, K. 2014a. Replacement of snow-trout (*Schizothorax zarudnyi*) by common carp in poly culture. Journal of Animal Researches (Iranian Journal of Biology), 26(4):435-442. In Farsi.

Aghili, K. 2014b. Study of penculture of the common carp (*Cyprinus carpio* L.) fingerlings at the Gorgan Bay to the maturity stage (broodstock management). Iranian Fisheries Science Research Institute, Tehran. 121 pp. In Farsi.

Aghili, K. and Aghaei Moghaddam, A. 2018. Heavy metals assessment in water and sediment of Gorgan Bay before and after rearing wild common carp (*Cyprinus carpio*) in pen culture (Khozeini Canal). Journal of Animal Environment, 10(4):331-338. In Farsi.

Aghili, K., Jafari, V., Aghaei Moghadam, A. A. and Haghparast, S. 2020. Study of benthic communities in enclosed cultures (penned) for wild carp breeding (*Cyprinus carpio*) in Gorgan Bay. Journal of Aquatic Ecology, Hormozgan University, 9(2):1-10. In Farsi.

Aghili, K. and Mohammadi, F. 2012. Study on catch estimation, age and length compositions of kutum (*Rutilus frisii kutum*) in the Gorgan Bay. Journal of Biology, 5(supplement 4)(series no. 19):89-98.

Aghili, K., Yeganeh, S. and Amini, K. 2018. The effects of age and weight of catched and cultivated broodstocks of wild carp (*Cyprinus carpio* Linnaeus, 1758) on some reproductive characteristics. Journal of Animal Environment, 10(2):171-176. In Farsi.

Aghili, S. M., Rasouli, P. and Abdoli, L. 2008. Possible impacts of the Alamut Dam construction on the fish fauna of Alamut and Taleghan streams (Sefid-Rud River basin). Environmental Sciences, 5(3):75-83. In Farsi.

Aghili, S. M., Safari, R., Imanpour, M. R., Salehi, H. and Rezvani Gilkolaee, S. 2017. Economic evaluation of carp production in Golestan Province. Journal of Utilization and Cultivation of Aquatics, 5(2):31-43. In Farsi.

Aghili, S. M., Safari, R., Shabanpour, B. and Rahmani, M. 2010. An analysis of the consumer market for aquatics and fishery products in Gorgan. New Technologies in Aquaculture Development (Journal of Fisheries), 4(3):91-100. In Farsi.

Aghilinejhad, S. M., Gorgin, S., Joolaie, R., Paighambari, S. Y., Ghorbani, R. and Mohammadi, J. 2017. Identifying factors involved in illegal fishing in the southwestern Caspian Sea. Journal of Fisheries (Iranian Journal of Natural Resources), 70(2):161-169. In Farsi.

Ahangarzadeh, M. 2015. Role of *Aeromonas hydrophila* in bacterial septicemia of cultured carps in Khouzestan Province and investigation on protectivity of bacterin(s) prepared from acute isolate(s) of it. Ph.D. Thesis, Shahid Chamran University of Ahvaz. 199 pp. In

Farsi.
Ahani, M. 2011. Environmental assessment of downstream water from Latian Dam using benthics as a biological index. International Conference on Chemical, Environmental and Biological Sciences, pp. 302-307, 7-8 October 2011, Pattaya, Thailand.
Ahani, N. and Alipour Eskandani, M. 2014a. Detection of enterotoxigenic *Staphylococcus aureus* in *Schizothorax zarudnyi* using PCR method. Zahedan Journal of Research in Medical Sciences (Tabib-e Shargh), 16(4):29-31.
Ahani, N. and Alipour Eskandani, M. 2014b. Detection of enterotoxigenic isolates of *Bacillus cereus* from nonenterotoxigenic in *Schizothorax zarudnyi* by PCR. Modern Genetics Journal, 9(2):245-249.
Ahmad, M. F. and Niazi, M. S. 1988. Important Edible Fishes of Pakistan. Zoological Survey Department, Government of Pakistan, Karachi. ix + 31 pp.
Ahmad Mir Mohammad Tabar, S., Petrossian, G. A., Mazlom Khorasani, M. and Noghani, M. 2021. Market demand, routine activity, and illegal fishing: An empirical test of routine activity theory in Iran. Deviant Behavior, 42(6):762-776.
Ahmadi, A., Borji, H., Naghibi, A., Nasiri, M. R. and Sharifiyazdi, H. 2017. Morphologic and molecular (28S r DNA) characterization of *Dactylogyrus* spp. in *Cyprinus carpio* and *Ctenopharyngodon idella* in Mashhad, Iran. Canadian Journal of Veterinary Research, 81(4):280-284.
Ahmadi, H., Kamrani, E., Khanipour, A. A., Akbarzadeh, A. and Homaei, A. 2019. Investigation of the physiological responses of *Rutilus frisii* fish to the stress caused by gill net. Journal of Animal Environment, 11(2):319-328. In Farsi.
Ahmadi, H., Naeemi, A. S., Nazarhaghighi, F. and Ghafuri, H. 2016. Subacute effects of copper oxide nanoparticles on some hematological indices and gill tissue of the juvenile carp (*Cyprinus carpio*). Journal of Aquaculture Development, 10(4):1-14. In Farsi.
Ahamdi, H., Yeganaeh, S. and Esmaeili Kharyeki, M. 2020. Investigation of antioxidant properties of hydrolyzed protein derived from common carp (*Cyprinus carpio*) viscera. Journal of Fisheries (Iranian Journal of Natural Resources), 73(4):593-606. In Farsi.
Ahmadi, M., Kashiri, H., Shabani, A. and Aghaei Moghadam, A. 2018. Genetic variability in wild and hatchery populations of commercially important fish: The common carp (*Cyprinus carpio*). Biodiversitas, 19(4):1468-1474.
Ahmadi, M. R. 1988. The basic principles of breeding in fish culture. Journal of the Veterinary Faculty of the University of Tehran, 44(1):1-20. In Farsi.
Ahmadi, M. R. 1993. Aquaculture industry in Iran, pp. 69-79. In: Chiu Liao, I., Shyu, C-Z. and Chao, N-H. (Eds.). Aquaculture in Asia. Proceedings of the 1990 Apo Asian Productivity Symposium on Aquaculture, Keelung, Taiwan. R.O.C. 5-13 September 1990.
Ahmadi, M. R. 2010. Ichthyofauna composition and diversity in some rivers of the western part of Iran. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).
Ahmadi, M. R., Kalbassi, M. R., Hosseini, Sh. B. and Lorestany, R. 2008. Assessment of sperm concentration, affect of activators and their pH on sperm motility in *Cyprinus carpio*. Journal of Marine Sciences and Technology, 7(1-2):13-19. In Farsi.
Ahmadi, M. R. and Rezai, M. 1998. Comparison of feeding preference and growth of grass carp (*Ctenopharyngodon idella*) fed different plant with emphasis on chemical composition. Journal of the Faculty of Veterinary Medicine, University of Tehran, 53(1/2):Pe1-Pe5.

Ahmadi, M. R. and Wossughi, Gh. 1988. Ein Beitrag zur fischereilichen Bedeutung des Hamun-Sees, Iran. Österreichs Fischerei, 41(10):209-216.

Ahmadi, S., Eagderi, S. and Javadzadeh, N. 2013. Comparative study on length and weight ratios and length-weight relationship in crucian carp (*sic*) (Cyprinidae: *Carassius auratus*) from Alagol Lake and Safidrud River. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 6 (abstract).

Ahmadi, S., Eagderi, S. and Javadzadeh, N. 2016. Body shape phenotypic plasticity of carassin (*Carrassius auratus*) (*sic*): A case study of Sefidrood River and Alagol Lake. Journal of Wetland Ecobiology, 8(1):107-115. In Farsi.

Ahmadi, S., Khodadadi, M., Roomiani, L. and Hakimi Mofrad, R. 2014. The embryonic development and formation of bunnei (*Barbus sharpeyi* Gunther, 1874). Iranian Scientific Fisheries Journal, 22(4):1-13. In Farsi.

Ahmadi, S., Khodadadi, M., Romiani, L. and Hakimi Mofrad, R. 2013. Investigation of embryonic development stages of Bani fish *(Barbus sharpeyi* Gunther, 1874*).* Iranian Journal of Fisheries, 4:1-13. In Farsi.

Ahmadi, S., Khodadadi, M., Salehi Farsani, A., Samadi Kuchaksaraei, B. and Mousavi-Sabet, H. 2013. Morphological development and growth of bunni, *Mesopotamichthys sharpeyi* (Günther, 1874), larvae reared in the laboratory. Aqua, International Journal of Ichthyology, 19(2):99-108.

Ahmadi, S. E., Vosoughi, A. R., Vatandoost, S., Ghelichi, A. and Seidanlou, Z. 2011. Some specific population structure of spirlin (*Alburnoides bipunctatus*) in the main cluster of Talar River in Mazandaran Province. Journal of Fisheries, 5(2):65-80. In Farsi.

Ahmadi, Z., Chitsaz, H. and Akrami, R. 2015. Compare the amount of fish consumption in rural and urban communities rely on both public and private jobs in Golestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 10(3):15-26. In Farsi.

Ahmadi, Z., Ghelichi, A., Kamali Sanzighi, M. and Sabbagh, M. 2015. Water physico-chemical characteristics relation with production value in warm water culture fishes ponds at east of Gonbad-e Kavous City, Golastan Province. Journal of Aquatic Animals and Fisheries, 6(21):77-89. In Farsi.

Ahmadian, A., Fattollahi, M., Nematollahi, A., Bigham Sadegh, A. and Arabi, M. 2017. The comparison of therapeutic effect of propolis extract and phenytoin on the wound of koi fish, *Cyprinus carpio haematopterus*. Journal of Animal Research (Iranian Journal of Biology), 39(1):22-32. In Farsi.

Ahmadian, E., Malekzadeh Viayeh, R. and Zahmatkesh, A. 2016. Caspian whitefish, *Rutilus frisii kutum* Kamensky, 1901 a potential aquaculture candidate: study on the cumulative effects of salinity and temperature on culture performance. Iranian Journal of Fisheries Sciences, 14(3):623-633.

Ahmadiara, E. 2013. Morphological and molecular study of Diphyllobothriidae family in *Abramis brama* and *Alburnoides bipunctatus* fishes. Ph.D. Thesis, University of Tehran.

Ahmadiara, E. 2017. Is *Ligula intestinalis* really a probable threat for public health? Journal of Food Quality and Hazards Control, 4:36.

Ahmadiara, E., Hosseini, S. H., Jalousian, F., Ebrahimzadeh Mousavi, H. A., Sakhaiifar, S. and Gerami Sadeghian, A. 2013. The study of the plerocercoid of diphyllobothriidae (cestoda, pseudophyllidea) (*sic*) in two cyprinid hosts, *Abramis brama* and *Alburnoides bipunctatus* from north and northwest of Iran. Iranian Journal of Veterinary Medicine, 7(2):103-109.

Ahmadifar, E., Akrami, R., Razeghi Mansour, M. and Kermat Amirkolaie, A. 2015. Effect of dietary supplementation of mannan oligosaccharide on growth performance and salinity tolerance in kutum, *Rutilus kutum* (Kamensky, 1901) fry. Journal of Applied Ichthyology, 31(1):173-76.

Ahamdifar, E., Enayat Gholampour, T., Shahriari Moghadam, M., Moghaddamfar, S. and Messaoudi, E. 2018. Study of herbal feed supplement (contains *Zataria* and *Satureja* powder) on growth performance, survival rate, biochemical blood characteristics and body composition in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(4):424-434. In Farsi.

Ahmadifar, E., Fadaee, M. and Enayat Gholampoor, T. 2014. Effects of dietary lipid sources on growth performance, salinity tolerance, haematological and biochemical parameters of Caspian roach (*Rutilus rutilus caspicus*) juvenile. Journal of Animal Researches (Iranian Journal of Biology), 27(2):155-164. In Farsi.

Ahmadifar, E., Heydari Sadegh, T., Dawood, M. A. O., Dadar, M. and Sheikhzadeh, N. 2020. The effects of dietary *Pediococcus pentosaceus* on growth performance, hemato-immunological parameters and digestive enzyme activities of common carp (*Cyprinus carpio*). Aquaculture, 516:734656.

Ahmadifar, E., Imanpoor, M., Zadmajid, V., Amini, K. and Falahatkar, B. 2017. Using analog implant LHRH methods and environmental factors (temperature and photoperiod) to out-of season goldfish culture (*Carassius auratus*). Journal of Animal Environment, 9(1):223-230. In Farsi.

Ahmadifar, E., Mehrinakhi, Z., Sheikhzadeh, N. and Shahriari Moghadam, M. 2020. Effects of grape seed extract (*Vitis vinifera*) on digestive enzymes and histology in common carp (*Cyprinus carpio*). Journal of Fisheries, 73(3):329-340. In Farsi.

Ahmadifar, E., Shahriari Moghadam, M. and Sheikzadeh, M. 2019. The effect of persimmon leaf extract (*Diospyros kaki*) as feed additive on some blood parameters and non-specific immune response in common carp (*Cyprinus carpio*). Journal of Aquaculture Sciences, 7(1):27-36. In Farsi.

Ahmadi-Mamaqani, Y., Khorasani, N., Talebi, K., Hasemi, S. A., Rafiee, G. and Bahadori-Khosroshahi, F. 2011. Diazinon fate and toxicity in the Tajan River (Iran) ecosystem. Environmental Engineering Science, 28(12):859-868.

Ahmadinejad, M., Oryan, S., Hosseinzadeh, H. and Khar, H. 2013. Comparison of the effects of LHRAH-A2 alone and in combination with pimozide (a dopamine antagonist) on spawning and reproduction quality indicators in *Rutilus frisii kutum* broodstocks. Journal of Utilization and Cultivation of Aquatics, 2(1):127-146. In Farsi.

Ahmadivand, S. 2014. Determination lethal concentration (LC_{50} 96 h) mercuric chloride ($HgCl_2$), lead chloride ($PbCl_2$) and zinc chloride $ZnCl_2$) on survival of goldfish (*Carassius auratus*). Journal of Utilization and Cultivation of Aquatics, 3(2):111-120. In Farsi.

Ahmadivand, S., Eagderi, S. and Imanpour, M. R. 2013a. Effects of stocking density on hematological parameters, growth and survival rate of Caspian roach (*Rutilus rutilus caspicus*) larvae. Journal of Chemical, Biological and Physical Sciences, 3(2):1320-1326.

Ahmadivand, S., Eagderi, S. and Imanpour, M. R. 2013b. The skeletal deformity in response of dietary phosphorus and calcium level in the Caspian roach (*Rutilus rutilus caspicus*) larvae. International Journal of Aquatic Biology, 1(3):93-99.

Ahmadivand, S., Eagderi, S. and Hasanpour, S. 2014. Study of skeletal disorders of Caspian

roach (*Rutilus caspicus* Yakovlev, 1870) larvae in response to phosphorus deficiency. Breeding and Aquaculture Sciences Quarterly, 2(4):11-18. In Farsi.

Ahmadivand, S., Imanpour, M. R., Eagderi, S. and Ahmadian, M. H. 2013. Changes in growth and carcass composition of Caspian roach (*Rutilus rutilus caspicus*) larvae in response to dietary phosphorus levels. Global Veterinaria, 10(1):18-21.

Ahmadivand, S., Keramat Amirkolaee, A. S., Oraji, H. and Ahmadivand S. 2015. The effects of dietary selenium nanoparticles (nano-se) in comparison with organic selenium (selemax) on growth performance in the diet of common carp, *Cyprinus carpio*. Journal of Animal Environment, 7(2):189-196. In Farsi.

Ahmadivand, S., Soltani, M., Shokrpoor, S., Rahmati-Holasoo, H., El-Matbouli, M. and Taheri-Mirghaed, A. 2020. Cyprinid herpesvirus 3 (CyHV-3) transmission and outbreaks in Iran: Detection and characterization in farmed common carp. Microbial Pathogenesis, 149:104321.

Ahmadnezhad, M., Bourani, M. S., Armoudli, R., Dajandiyan, S., Dadgar, S. and Khara, H. 2017. Hematological changes in the male koi fishes (*Cyprinus carpio*) exposed to electromagnetic waves of mobile phone (900 MHz). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Ahmadnezhad, M., Oryan, Sh., Hosseinzadeh Sahafi, H. and Khara, H. 2013. Effect of synthetic luteinizing hormone-releasing hormone (LHRH-A2) plus pimozide and chlorpromazine on ovarian development and levels of gonad steroid hormones in female kutum *Rutilus frisii kutum*. Turkish Journal of Fisheries and Aquatic Sciences, 13(1):95-100.

Ahmadnezhad, M., Oryan, Sh., Hosseinzadeh Sahafi, H., Khara, H. and Sattari, M. 2012. Effects of LHRH-A_2 and chlorpromazine (dopamine antagonists) on inducing spawning in Caspian kutum, *Rutilus frisii kutum*, from the southwest of the Caspian Sea. Caspian Journal of Environmental Sciences, 10(1):33-42.

Ahmadnezhad, M., Sayad Bourani, M., Dejandiyan, S., Matinfar, A. and Khara, H. 2018. The effect of electromagnetic waves of cell phones on hematological and reproductive indices of koi fish (*Cyprinus carpio*) broodstocks. Aquatic Physiology and Biotechnology, 6(1):95-116. In Farsi.

Ahmadnia, H., Hajimoradloo, A., Ghorbani, R. and Afgh, N. 2017. Effects of lactoferrin and *Lactobacillus rhamnosus* PTCC 1637 on some physiological parameters and histology of gut and ovary of *Carassius auratus* brood stocks. Journal of Animal Environment, 9(2):175-182. In Farsi.

Ahmadniaye Motlagh, H., Safari, O., Zare, M., Baghalian, A., Kia, E., Parsa, E. and Rohani, E. 2017. Effect of different levels of apple vinegar on growth indices and digestive enzymes activities in *Carassius auratus*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 290-294. In Farsi.

Ahmadpour, M., Ahmadpour, M., Hoseini, S. H., Ghasempouri, S. M., Jafari, A., SinkaKarimi, M. H. and Amouie, H. 2012. A survey of the flora and the fauna of the Fereydunkenar International wetland for better conservation management. Journal of Biodiversity and Environmental Sciences, 2(10):17-26.

Ahmadzadeh, M., Poorbagher, H. and Eagderi, S. 2019. Calculating the habitat suitability index of siahmahi (*Capoeta buhsei*, Kessler 1877) using the kernel smoothing in the Jajrood River, Namak basin of Iran. Journal of Aquaculture Sciences, 6(2):99-108. In Farsi.

Ahmadzai, B. 2017. Fish Value Chain Analysis and Fisheries Sector Development Opportunities-Afghanistan. Ministry of Agriculture Irrigation and Livestock (MAIL),

Kabul-Afghanistan. iv + 58 pp.
Ahmed, A. H. and Taher, M. M. 1988. Observations on the extensive and intensive cultured carp, Cyprinus carpio L. in Basrah, Iraq. Basrah Journal of Agricultural Science, 1:35-47.
Ahmed, H. A. 1982. Crowth (sic) of the cyprinid fish, *Barbus luteus* (Heckel) in Tharthar Reservoir, Iraq. Bulletin of the Basrah Natural History Museum, 5:3-15.
Ahmed, H. A., Al-Mukhtar, M. A. and Al-Adhub, A. H. Y. 1984. The reproductive biology of *Carasobarbus luteus* (Pisces, Cyprinidae) in Al-Hammar Marsh, Iraq. Cybium, 8(4):69-80.
Aisenstein, B. 1947. The “kahrez”, an ancient system of artificial springs. Journal of the Association of Engineers and Architects in Palestine, 8:2-3.
Aitchison, J. E. T. 1889. The Zoology of the Afghan Delimitation Commission. Introduction. Transactions of the Linnaean Society of London, Second Series, Zoology, 5:53-55, 2 maps.
Akbari, E., Meshkini, S. and Esmaeilnejad, B. 2020. Effect of oxidative stress caused by Dactylogyrus (Monogenea: Dactyolgyridae) parasites on DNA damage, lipids and proteins in gill tissue of common carp (Cyprinus carpio). Journal of Comparative Pathobiology Iran, 16(4):2693-2972. In Farsi.
Akbari Nargesi, E., Falahatkar, B. and Grouhi, B. 2021. Spermatozoa motility time and percentage in the Caspian Kutum (*Rutilus kutum*) during chilled storage. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Akbari Nargesi, E., Rahmati, M. and Fallahkar, B. 2018. Characteristics of morphometric and gonadosomatic indices of male and female redfish (*Scardinius erythrophthalmus*) broodstock in Anzali Wetland. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Akbari-Pasand, A. 1996. Biological study of the Caspian roach. Abzeeyan, Tehran, 7(8):14-16. In Farsi.
Akbarian, H., Alaf Navarian, H., Bani, A. and Falahatkar, B. 2012. Effects of tank color on growth performance and body composition of common carp (*Cyprinus carpio*) in cultural condition. Journal of Utilization and Cultivation of Aquatics, 1(2):19-30. In Farsi.
Akbarian, M. A., Hosseinzadeh, H., Seyfabadi, J. and Sarafraz, S. 2009. Effect of light intensity and photoperiod on growth and survival of kutum roach early stages. Annual Meeting of the American Society of Ichthyologists and Herpetologists, 22-27 July 2009, Portland, Oregon (abstract).
Akbarian Aghdam, A., Ahamdvand, A. M. and Alimohammadi, S. 2015. Long term river discharge scenarios estimation under climate change impacts (Case study: Karun 4 catchment area). Environmental Sciences, 13(2):23-46.
Akbaripasand, A. 1999. Ecological investigation of fishes of Gorganroud River in the National Park of Golestan. M.Sc. Thesis, Tarbiat Modarres University, Tehran. 114 pp. In Farsi.
Akbarnezhad, M., Khodadadi, M. and Akbarnezhad, M. 2010. Surveying the embryonic and pre-larval development of barb, *Barbus grypus* (Heckel, 1843). Journal of Wetland Ecobiology, 2(3):67-79. In Farsi.
Akhani, H. 2015. Iran’s environment under siege. Science, 350(6259):392.
Akhavan, R. S., Eslamloo, K. and Jamalzad, F. 2013. Effect of acute stresses on the variations of cortisol, antiproteases and hematology of goldfish (*Carassius auratus*). Journal of

Aquaculture Development, 8(2):23-35. In Farsi.
Akhavan-Roufigar, H. 1991. Study on Acanthocephalans in *Capoeta* spp. in Mahabad Dam. Doctor of Veterinary Medicine Thesis, University of Urmia, Urmia. 206 pp.
Akhlaghi, M. 2000. Immunogenicity of *Aeromonas hydrophila* in common carp (*Cyprinus carpio*, L). Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(1):62-67. In Farsi.
Akhlaghi, M. 2001. Bacterial diseases of cultured carp in Iran. In: 6th Asian Fisheries Forum Book of Abstracts, Kaosiung, Taiwan, 25-30 November 2001. p. 5.
Akhlagi, M. 1999. Effect of stress factors in the occurrence of *Aeromonas hydrophila* infection in cultured carp. Iranian Scientific Fisheries Journal, 7(4):1-8, 1. In Farsi.
Akhlagi, M. and Anharaki Motlagh, M. 2004. Phagocytic changes in common carp (*Cyprinus carpio*) following administration of immunostimulants Quil-A and levamisole. Iranian Scientific Fisheries Journal, 13(3):1-12. In Farsi.
Akhondzadeh, A., Zahraie Salehi, T. and Misaghi, A. 2002. The survey of *Listeria monocytogenes* in fresh and smoke fish and ice used in fish markets for retaining the freshness of fish in Tehran and Gilan. Journal of the Faculty of Veterinary Medicine University of Tehran, 57(4):9-12. In Farsi.
Akhondzadeh Basti, A. 2004. The study of bacterial pathogens and fungi in fresh fish and heavy salted fish in Gilan. The 4th International Iran and Russia Conference “Agriculture and Natural Resources”, 8-10 September 2004, Shahr-e Kord, Iran (title).
Akhondzadeh Basti, A., Misaghi, A. and Zahrae Salehi, T. 2003. The study of fungi and bacterial pathogens in fresh and salted cold smoked fish in Iran. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).
Akhondzadeh Basti, A., Misaghi, A., Zahraei Salehi, T. and Kamkar, A. 2006. Bacterial pathogens in fresh, smoked and salted Iranian fish. Food Control, 17(3):183-188.
Akhondzadeh Basti, A. and Zahrae Salehi, T. 2003. Incidence of *Listeria monocytogenes* in fresh and smoked fish in Iran. American Fisheries Society Symposium, 38:163-165.
Akhondzadeh Basti, A., Zahrae Salehi, T. and Misaghi, A. 2003.The incidence of Listeria monocytogenes in fresh and smoked fish in Iran. European Aquaculture Society, Aquaculture Europe 2002, Parallel Session VII: Quality aspects, safety and public image of aquaculture products, p. 117.
Akhoundian, M. and Movahedinia, A. 2017. Study of some histomorphometric indices in oocyte of roach (*Rutilus rutilus caspicus*), during reproduction cycle. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 799-809. In Farsi.
Akhoundian, M., Salamat, N., Savari, A., Movahedinia, A. and Salari, M. A. 2020. Influence of photoperiod and temperature manipulation on gonadal development and spawning in Caspian roach (*Rutilus rutilus caspicus*): implications for artificial propagation. Aquaculture Research, 51(4):1623-1642.
Akhoundian, M., Savari, A., Salamat, N., Movahedinia, A. and Salari, M. A. 2016. Ovarian development of Caspian roach, *Rutilus caspicus*, in southern Caspian Sea: A histological and ultrastructural study. International Journal of Aquatic Biology, 4(6):391-399.
Akhrorov, F. and Kondur, L. V. 1981. The diet of commercial fish in Pamir lakes. Izvestiya Akademii Nauk Tadzhikskoi SSR (Otdelenie Biologicheskhikh Nauk), 1981(1):48-53. In Russian.
Akmali, V., Esmaeili Rineh, S. and Ali, F. 2010. Diversity and distribution of subterranean

species in karst areas of Iran. 20th International Conference on Subterranean Biology, Postojna, Slovenia, 29 August-3 September 2010 (poster).

Akpınar, M. A. 1999. Besinsel Yağ Asitlerinin ve Açlığın *Cyprinion macrostomus* Heckel, 1843'un Kas Dokusu Yağ Asidi Bileşimine Etkisi [Effect of dietary fatty acids and starvation on the fatty acid composition in the muscle tissue of *Cyprinion macrostomus* Heckel, 1843]. Turkish Journal of Biology, 23(3):309-317.

Akpınar, M. A. and Aksoytlar, M. Y. 1989. *Cyprinion macrostomus* Heckel, 1843'un Kas Dokusu Yağ Asidi Bileşiminin Sı Caklı Kla Ilişkişi [Relation to temperature of fatty acid composition in muscle tissue of *Cyprinion macrostomus* Heckel, 1843]. Doğa Türk Biyoloji Dergisi, Ankara, 13(2):57-62.

Akram, A., Elhami, B. and Khanali, M. 2019. Investigating and predicting the amount of environmental impact in breeding warm water fish in Guilan Province using comparative neuro-fuzzy inductive inference system. Iranian Journal of Biosystems Engineering (Iranian Journal of Agricultural Sciences), 50(3):717-735. In Farsi.

Akrami, R., Barati, M. and Chitsaz, H. 2011. The effect of dietary mannan oligosaccharide on growth, survival, body composition and salinity stress tolerance of Caspian roach (*Rutilus rutilus*) fry. Journal of Marine Biology, 3(3):65-71. In Farsi.

Akrami, R., Chitsaz, H., Bahmadi, M., Abdollahzadeh, E. and Razeghi Mansour, M. 2015. Effects of dietary garlic oil on haematological, immunity and blood serum biochemical parameters of common carp (*Cyprinus carpio*). Journal of Aquatic Animals and Fisheries, 6(22):25-34. In Farsi.

Akrami, R., Chitsaz, H., Dashtian, S. and Razeghi, M. M. 2013. Single or combined effects of inulin and mannan oligosaccharide supplements on the growth performance, survival, body composition and salinity resistance of kutum (*Rutilus frisii kutum*) fry. Journal of Fisheries Science and Technology, 2(3):17-29. In Farsi.

Akrami, R., Ghabeli, B., Vahabzadeh Rudsari, H. and Razeghi Mansour, M. 2014. Effect of betafin as feed attractant on growth performance, survival, body composition and resistance to stress of Caspian roach (*Rutilus rutilus*). New Technologies in Aquaculture Development (Journal of Fisheries), 8(3):47-55. In Farsi.

Akrami, R., Ghelichi, A. and Zarei, E. 2012. Effect of dietary supplementation of prebiotic inulin on growth, survival, lactic acid bacteria loading and body composition of carp (*Cyprinus carpio*) juvenile. Journal of Fisheries, 5(4):87-94. In Farsi.

Akrami, R., Ghelichi, A. and Zarei, E. 2018. The use of prebiotics in aquaculture. New Technologies in Aquaculture Development (Journal of Fisheries), 12(1):8-16. In Farsi.

Akrami, R., Khanahmadi, A. and Chitsaz, H. 2013. Effect of prebiotic mannan oligosaccharide and ß-1, 3-glucan on growth, survival and body composition of carp juvenile (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 7(1):55-64. In Farsi.

Akrami, R., Mallah, Y. and Chitsaz, H. 2013. Effect of prebiotic mannan oligosaccharide and β-1, 3 glucan on growth performance, survival and body composition of kutum (*Rutilus frisii kutum*) fry. Breeding and Aquaculture Sciences Quarterly, 1(3):11-22. In Farsi.

Akrami, R., Rahnama, B., Chitsaz, H. and Razeghi Mansour, M. 2015. Effects of dietary inulin on growth performance, survival, body composition, stress resistance and some hematological parameters of gibel carp juveniles (*Carassius auratus gibelio*). Iranian Journal of Fisheries Sciences, 14(4):1072-1082.

Akrami, R. and Shamloofar, M. 2017. The effect of onion powder (*Allium cepa*) on some

immune, biochemical parameters and blood serum enzymes of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 11(4):1-12. In Farsi.

Alaei Borujeni, P., Mortazavi, S. A. and Salehi, H. 2015. Maximum sustainable yield estimation of kutum (*Rutilus frisii kutum*) fishing in Iranian coasts of the Caspian Sea: application of age-structured models. Iranian Journal of Fisheries Sciences, doi:10.13140/RG.2.1.1861.5844 (published version not seen, downloaded from ResearchGate).

Alaei Borujeni, P., Steinshamn, S. I., Mortazavi, S. A. and Salehi, H. 2015. Enhance and advance: The benefits of recruitment enhancement in the case of the Iranian kutum fishery. Marine Policy, 61:23-32.

A'lam, H. 1999. (Fish). iii. In pre-Islamic Persian lore, pp. 671-672. In: Yarshater, E. (Ed.). Encyclopædia Iranica. Bibliotheca Persica Press, New York. Volume IX, Fascicle 6. Festivals VIII-Fish.

Alam, H. No date. Fish and fisheries, 14 pp. In: Yarshater, E. (Ed.). Encyclopædia Iranica. Bibliotheca Persica Press, New York. www.bibliothecapersica.com/, downloaded 13 December 2006.

Alamouti, A. M. 1966. Groundwater resources of Iran, pp. 415-430. In: Symposium on Hydrology and Water Resources Development held in Ankara, Turkey February 7 to 12, 1966, Central Treaty Organization, Ankara. 484 pp.

Al-Ansari, N., Abdellatif, M., Ali, S. S. and Knutsson, S. 2014. Long term effect of climate change on rainfall in northwest Iraq. Central European Journal of Engineering, 4(3):250-263.

Al-Asfour, T. 1978. The marine terraces of Kuwait, pp. 245-254. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.

Al-Aswad, M. B., Abo-Alnaja, I. J., Salman, A. J. and Ahmed, N. H. 1980. Chemical and bacteriological study on some commercially important fish in Dukan Lake. I. Chemical study. Zanco, Sulaimaniyah University, 6(3):81-98.

Alavi, S. M. H. 2002. Threatened fish species in the southern part of the Caspian Sea. Program of the 26th Annual Larval Fish Conference (22-26 July 2002, Bergen, Norway). 1 p.

Alavi Talab, H., Arjmand, M., Motalebi, A. A. and Pourgholam, R. 2010. Optimization of morphology and geometry of encapsulated *Hypophthalmichthys molitrix* oil. Iranian Journal of Fisheries Sciences, 9(2):199-208.

Alavi Talab, H., Tavvakoli Pour, H. and Ghoroghi, A. 2007. Investigation and comparison of quality of fitofague's (*sic*) skins and fins acidic and alkaline gelatin with another source. Pajouhesh va Sazandegi, 19(3)(72):50-57. In Farsi.

Alavi-Yeganeh, M. S., Aazami, J., Nemati Varnosfaderany, M. and Nozarpour, N. 2018. Length-weight and length-length relationships of *Oxynoemacheilus frenatus* (Heckel, 1843) and *Petroleuciscus esfahani* Coad & Bogutskaya, 2010 from the Cheshmeh-Langan river, Iran. Journal of Applied Ichthyology, 34(3):768-770.

Alavi-Yeganeh, M. S., Razavi, S., Aazami, J., Nemati Varnosfaderany, M. and Kamali, M. 2018. Length-weight and length-length relationships of three algae-scraping cyprinid species from Iran. Journal of Applied Ichthyology, 34(5):1241-1243.

Alboghobeish, N. and Hamidian, Gh. R. 2006. Alarm cells and their distribution in different regions of *Barbus sharpeyi* skin. Iranian Scientific Fisheries Journal, 15(2):1-8. In Farsi.

Alboghobeish, N. and Moosavi, S. M. 1998. Light and electron microscopic studies of phyarynx

(*sic*) and osophagus (*sic*) of barbus (*sic*) sharpeyi fish. Journal of the Faculty of Veterinary Medicine, University of Tehran, 53(1-2):75-90.

Alboughobish, N. and Khaksari Mahabadi, M. 2005. Histological study of liver and pancreas in *Ctenopharyngodon idella*. Iranian Veterinary Journal, 9(11):25-34. In Farsi.

Alboughobish, N., Peyghan, R. and Hamidian, Gh. R. 2006. Mucous secreting chief cells and their distribution in different regions of epidermis in *Barbus sharpeyi* skin. Iranian Veterinary Journal, 2(2)(13):102-111. In Farsi.

Al-Dabical, A. Y. and Al-Daham, N. K. 1995. The growth of *Aspius vorax* Heckel in the first year of age at Shatt Al-Basrah Canal. Marina Mesopotamica, 8(2)(1993):344-354. In Arabic.

Al-Daham, N. K. 1982. The ichthyofauna of Iraq and the Arab Gulf: A check-list. Publications of the Basrah Natural History Museum, 4:1-102.

Al-Daham, N. K. and Bhatti, M. N. 1979. Annual changes in the ovarian activity of the freshwater teleost, *Barbus luteus* (Heckel) from Southern Iraq. Journal of Fish Biology, 14(4):381-387.

Al-Daham, N. K., Sarker, A. L. and Al-Nasiri, S. K. 1981. Industrial pollution of inland waters in Iraq - A fishery problem. The Arab Gulf, Basrah, 13(1):17-25.

Al-Daham, N.K. and Yousif, A. Y. 1990. Composition, seasonality and abundance of fishes in the Shatt Al-Basrah Canal, an estuary in Southern Iraq. Estuarine, Coastal and Shelf Science, 31(4):411-421.

Al-Habbib, O. A. M. 1981. Acclimation to temperature and death at changing lethal temperatures in the freshwater fish *Chalcalburnus chalcoides*. Journal of Thermal Biology, 6(4):365-371.

Al-Habbib, O. A. M. and Al-Habbib, W. M. S. 1979. Acclimation to temperature and death at high changing lethal temperatures in *Cyprinion macrostomus* (Heckel). Journal of Thermal Biology, 4(1):75-77.

Al-Habbib, O. A. M., Salih, W. A. and Hamed, K. M. 1986. Seasonal variation in the biochemical composition of the skeletal muscle of the freshwater fish *Barbus barbulus* (Heckle) (*sic*). Journal of Biological Sciences Research, Baghdad, 17(1):219-225.

Al-Hakim, A. W. H., Al-Mehdi, M. I. A. and Al-Salman, A. H. J. 1981. Determination of age, growth and sexual maturity of *Barbus grypus* in the Dukan reservoir of Iraq. Journal of Fish Biology, 18(3):299-308.

Al-Hakim, A. W. H., Niazi, A. D. and Al-Ani, B. J. 1976. A study on the morphological characters and determination of sexual maturity in fishes, *Barbus sharpeyi* Gunther and *Barbus grypus* Heckel. Bulletin of the Natural History Research Centre, Baghdad, 7(1):177-179.

Al-Hamed, M. I. 1960. Carp-culture in Iraq. Iraqi Journal of Agricultural Research, 1(2):14-23, 3. In Arabic.

Al-Hamed, M. I. 1965. On the morphology of the alimentary tract of three cyprinid fishes of Iraq. Bulletin of the Iraq Natural History Museum, Baghdad, 3(4):1-25.

Al-Hamed, M. I. 1966a. On the age and growth of three cyprinid fishes of Iraq. Ministry of Agriculture, Baghdad, Technical Bulletin, 135:1-70.

Al-Hamed, M. I. 1966b. On the reproduction of three cyprinid fishes of Iraq. Ministry of Agriculture, Baghdad, Technical Bulletin, 136:1-26.

Al-Hamed, M. I. 1971. Salinity tolerance of common carp (*Cyprinus carpio*, L.). Bulletin of the Iraq Natural History Museum, Baghdad, 5(1):1-7.

Al-Hamed, M. I. 1972. On the reproduction of three cyprinid fishes of Iraq. Freshwater Biology, 2(1):65-76.
Al-Hashimi, A. 1987. Pollution of a river: How to prevent it. International Journal of Environmental Studies, 29(4):307-313.
Al-Hassan, L. A. J. 1982. The use of electrophoresis in the identification of fish stock, and its future application in the Arabian Gulf. Journal of the Faculty of Marine Science, Jeddah, 2:81-84.
Al-Hassan, L. A. J. 1984. Comparative electrophoretic studies of muscle and eye lens proteins in freshwater fish of Iraq. Biochemical Systematics and Ecology, 12(2):205-208.
Al-Hassan, L. A. J. 1985. Phosphoglucose isomerase and phosphoglucose mutase isozymes in some freshwater fishes from Basrah, Iraq. Biochemical Systematics and Ecology, 13(3):357-364.
Al-Hassan, L. A. J. 1994. The silver carp, *Hypophthalmichthys molitrix* (Cyprinidae) in the Shatt Al-Arab River, Iraq. Cybium, 18(2):204.
Al-Hassan, L. A. J., Al-Saboonchi, A. A. and Binayan, L. A. A. 1986. A record-size cyprinid fish, *Barbus xanthopterus* (Heckel) from Shatt Al-Arab river, Iraq. Cybium, 10(2):204.
Al-Hassan, L. A. J. and Elias, N. H. 1987. Isoenzymes of cyprinids from the vicinity of Basrah in relation to classification. Biochemical Systematics and Ecology, 16(2):223-226.
Al-Hassan, L. A. J., Hussain, N. A. and Soud, K. D. 1989. A preliminary, annotated check-list of the fishes of Shatt Al-Arab River, Basrah, Iraq. Polskie Archiwum Hydrobiologii, 36(2):283-288.
Al-Hassan, L. A. J. and Muhsin, K. A. 1986. The presence of *Barbus luteus* and *Heteropneustes fossilis* in the Khor al Zubair, in the North-West of the Arabian Gulf. Zoology in the Middle East, 1(1):116-118.
Al Hazzaa, R. 2005. Some biological aspects of the himri barbel, *Barbus luteus*, in the intermediate reaches of the Euphrates River. Turkish Journal of Zoology, 29(4):311-315.
Al Hazzaa, R. and Hussein, A. 2003a. Stickiness elimination of himri barbel (*Barbus lutes* (*sic*), Heckel) eggs. Turkish Journal of Fisheries and Aquatic Sciences, 3(1):47-50.
Al Hazzaa, R. and Hussein, A. 2003b. Initial observations in himri (*Barbus lutes*, (*sic*) Heckel) propagation. Turkish Journal of Fisheries and Aquatic Sciences, 3(1):41-45.
Al Hazzaa, R. and Hussein, A. 2003c. Propagation attempts in himri barbel (*Barbus luteus*, Heckel). Proceedings of the International Conference on Fish Welfare and Food Security in Arab and Muslim Countries, 22-24 October, Azhar University, Cairo, Egypt (title).
Al Hazzaa, R. and Hussein, A. 2007. Larval development of himri, *Barbus luteus* (Cyprinidae: Cypriniformes) reared in the laboratory. Turkish Journal of Zoology, 31(1):27-33.
Al-Hosseini, S. A. S. and Akrami, R. 2013. Effect of betaine as feed attractant on growth, survival and resistance to heat and salinity stressors on wild common carp (*Cyprinus carpio*) juvenile. Journal of Applied Ichthyological Research, 1(3):15-24. In Farsi.
Ali, A. A. 1979. Study of morphological and biological characteristics of gattan (*Barbus xanthopterus*) from river Tigris and Al-Tharthar reservoir. The Arab Gulf, 11(1):181-197.
Ali, A. H. 2008. Determination of some morphological criteria of crussian (*sic*) carp *Carassius auratius* (*sic*) *gibelio* communities and gold fish *Carassius auratus* in three water bodies in Basrah Province. Basrah Journal of Agricultural Sciences, 21(1):107-122.
Ali, A. M. 1969. Morphometric features of the gattana (*Barbus xanthopterus* (Heck.)). Journal of the Arab Gulf, Basrah, 11(1):3-11. In Arabic.
Ali, A. M. 1974. Fecundity and histological description of the gonads of the female asp (*Aspius

aspius). Journal of Ichthyology, 14(6):896-903.

Ali, A. M. 1979. Study of morphological and biological characteristics of gattan *Barbus xanthopterus* from Tigris River and Al-Tharthar water reservoir. The Arab Gulf, 11(1):181-197. In Arabic.

Ali, A. M. 1980. Determination of length coefficient and mesh size and some *Barbus* spp. The Arab Gulf, University of Basrah, 12(1):215-221. In Arabic.

Ali, A. M. 1982a. Morphological characteristics of himri (*Barbus luteus* G. (*sic*) from the reservoir of Tharthar and the River Tigris. Programme of the Fourth Congress of European Ichthyologists, 20.-24. 9. 1982, Hamburg, West Germany (abstract).

Ali, A. M. 1982b. On the biology of bunni (*Barbus sharpeyi*) from Mesopotamia. Programme of the Fourth Congress of European Ichthyologists, 20.-24. 9. 1982, Hamburg, West Germany (abstract).

Ali, A. M. 1985. Morphometric characteristics of the khimri, *Barbus luteus* (Cyprinidae), from Tartar Reservoir and the Tigris River (Iraq). Journal of Ichthyology, 25(5):168-171.

Ali, A. M., Tertar, T. M. and Tomas, N. K. 1981. Morphological and activity characteristics of the fish *Barbus grypus* in Al-Therthar Reservoir and Tigris River. Journal of the Arab Gulf, Basrah, 13(3):117-128. In Arabic.

Ali, M. D., Ali, A. M. and Zaki, L. M. 1986. The general condition and calorific value of the freshwater fish Aspius vorax and Barbus luteus in Al-Tharthar Reservoir. Journal of Biological Sciences Research, Baghdad, 17(2):223-230.

Ali Asghari, M., Taheri, H. and Ghobadi, S. 2013. Effect of starvation and compensation growth on growth performance, survival and body composition of common carp *Cyprinus carpio* fry. Breeding and Aquaculture Sciences Quarterly, 1(1):61-70. In Farsi.

Ali Kehkha, A. O. and Cacho, O. 2005. The Hirmand River: conflicts and resolutions. Program & Abstracts, 8th International Riversymposium 2005, 6-9 September, Brisbane, Australia (abstract).

Ali Noori, S. M., Khanzadi, S., Fazlara, A., Najafzadeh Varzi, H, and Azizzadeh, M. 2017. Effect of lactic acid on microbiological and chemical indices of common carp fillets during storage at 4°C. Journal of Food Microbiology, 4(1):41-51. In Farsi.

Aliabadi, T., Adeli, A. and Pourhoseingholi, M. A. 2015. Study of behavior of consumers related to farmed and wild fish in Gorgan city. New Technologies in Aquaculture Development (Journal of Fisheries), 9(1):103-110. In Farsi.

Aliakbarian, A., Shabani, A. and Shabanpour, B. 2014. Comparison of *Capoeta capoeta gracilis* genetic populations in Madarsu and Gorganrud rivers by using microsatellite marker. Modern Genetics Journal, 9(1):39-48. In Farsi.

Alian, Sh., Shahsavani, D. and Baghshani, H. 2013. Investigation of tissue enzymes alterations following cyanide poisoning in common carp (*Cyprinus carpio*). Iranian Veterinary Journal, 8(4):44-51.

Aliasghari, M., Ghobadi, S. and Khodabakhsh, E. 2013. Effects of different light colors on survival and growth factors of koi carp *Cyprinus carpio* larvae. Renewable Natural Resources Research, 3(4):1-8.

Alibekov, L. A. 1994. Iskysstvo drevnikh gidrotekhnikov i pust’ne [Art of ancient hydrotechnicians in deserts]. Priroda, 9(949):93-99.

Alidoust, S., Esmaeili Sari, A. and Bahramifar, N. 2015. Bioaccumulation of total and organic mercury in goldfish (*Carassius auratus gibelio*) in Anzali Wetland, and assessment of

health risks. Journal of Mazandaran University of Medical Sciences, 24(120):242-252. In Farsi.

Aliev, D. S., Sukhanova, A. I. and Shakirova, F. M. 1987. Redkie i ischezayushchie vidy ryb Turkmenistana [Rare and endangered species of fish in Turkmenistan]. Izvestiya Akademii Nauk Turkmenskoi SSR, Seriya Biologicheskikh Nauk, 1987(1):70-71.

Aliev, D. S., Sukhanova, A. I. and Shakirova, F. M. 1988. Ryby vnutrennikh vodoemov Turkmenistana [Fishes of the inland waters of Turkmenistan]. Ylym, Ashkhabad. 142 pp., 11 pls.

Alijani, R., Vafakhah, M. and Malekian, A. 2016. Spatial and temporal analyses on monthly stream flow deficit intensity in Gorganroud watershed, Iran. Ecopersia, 4(1):1313-1329.

Alijani Ardeshir, R., Zolgharnien, H., Movahedinia, A., Salamat, N., Zabihi, E. and Rastgar, S. 2019. Measurement of DNA damage by CellProfiler software in the liver of Caspian white fish exposed to environmental concentrations of fipronil. Computational Toxicology, 12:100105.

Alijanpor, E., Vatandust, S., Naderi Jelodar, M. and Gorjian Arabi, M. H. 2014. Review of population structure factors of *Capoeta trutta* in Gamasyab River at Hamadan province. Journal of Animal Environment, 6(2):113-124. In Farsi.

Alijanpour, N., Amiri, K., Bani, A., Saremi, T., Mirjavid, S. A., Tizkar, B. and Nazari, R. M. 2014. Color and caretonoid content of egg in migratory kutum (*Rutilus frisii kutum*) in Shirud and Tajan Rivers (Mazandaran Province). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Alijanpour, N., Bani, A., Tizkar, B., Amiri, K. and Nazari, R. M. 2015. Carotenoid content and colour of eggs in migratory broodstock kutum (*Rutilus frisii kutum* Kamensky, 1901) (Osteichthyes: Cyprinidae) in the Shirud and Tajan Rivers, south Caspian Sea. Italian Journal of Zoology, 82(1):25-32.

Alijanpour, N. and Fallah Shamsi, S. Z. 2008. Effects of age, egg diameter, egg color, fish length, fish weight, time and temperature of water on fecundity and fertilization percent of female Southern Caspian kutum (*Rutilus frisii kutum*) migrant to Shiroud River. Bachelor of Fisheries Project, Islamic Azad University of Lahijan, Iran.

Alimohammadi, S. R., Bozorgnia, A., Hosseinifard, S. M. and Raissi, M. 2010. Changes of blood parameters in acute effects of different temperature of common carp (*Cyprinus carpio*). Journal of Veterinary Pathobiology (Journal of Veterinary Modern Research), 1(4):49-54, 7. In Farsi.

Alinejad, S. and Shoaibi Omrani, B. 2019. Study and identification of external parasites in imported goldfish (*Carassius auratus*). Journal of Utilization and Cultivation of Aquatics, 8(2):31-40. In Farsi.

Alinezhad, S. 2019. Effects of diet containing dry extracts of *Achillea millefolium*, *Mentha piperita* and *Echinacea purpurea* on growth, hematological and immunological indices in juvenile common carp (*Cyprinus carpio*). Iranian Journal of Aquatic Animal Health, 5(1):1-16.

Aliniya, M., Khara, H., Baradaran Noveiri, S. and Dadras, H. 2013. Influence of age of common carp (*Cyprinus carpio*) broodstock on reproductive traits and fertilization. Turkish Journal of Fisheries and Aquatic Sciences, 13(1):19-25.

Aliniya, M., Nezami, S., Khara, H., Baradaran Noveiri, S. and Dadras, H., 2011a. The relationship between age of male broodfish and efficiency of artificial fertilization in

common carp (*Cyprinus carpio*). The First National Conference on Aquaculture, Iran-Anzali. November 29-30, 2011 (poster).

Aliniya, M., Nezami, S., Khara, H., Baradaran Noveiri, S. and Dadras, H., 2011b. The comparison of biochemical and ionic characteristics of sperm in different age group in common carp (*Cyprinus carpio*). The First National Conference on Aquaculture, Iran-Anzali, November 29-30, 2011 (poster).

Aliniya, M., Nezami Baloochi, Sh. A., Khara, H., Baradaran Noveiri, Sh. and Dadras, H. 2013. The relationship between age of male broodstocks and artificial propagation efficiency in common carp (*Cyprinus carpio*). Journal of Fisheries, 7(2):23-30. In Farsi.

Alipour, Gh. H., Shaabanpour B., Shaabani, A. and Imanpour, M. R. 2009. Effects of brine concentration and temperature on quality of mahi sefid (*Rutilus frisii kutum*) smoked by traditional method. Journal of Agricultural Sciences and Natural Resources, 16(Special Issue 1-A). In Farsi.

Alipour, H. and Banagar, Gh. R. 2018. Health risk assessment of selected heavy metals in some edible fishes from Gorgan Bay, Iran. Iranian Journal of Fisheries Sciences, 17(1):21-34.

Alipour, H., Pourkhabbaz, A. and Hassanpour, M. 2013. Assessing of heavy metal concentrations in the tissues of *Rutilus rutilus caspicus* and *Neogobius gorlap* from Miankaleh International Wetland. Bulletin of Environmental Contamination and Toxicology, 91(5):517-521.

Alipour, H., Pourkhabbaz, A. and Hassanpour, M. 2016. Determination of metals (As, Cu, Fe, and Zn) in two fish species from the Miankaleh wetland. Archives of Polish Fisheries, 24(2):99-105.

Alipour, N. and Avokhisemi, M. 2013. A study on effectiveness of aquaponic system on growth and survival enhancement of juvenile freshwater prawn and larval carp. Journal of Utilization and Cultivation of Aquatics, 2(3):99-110. In Farsi.

Alipour, R. and Nohani, E. 2014. Flow simulation in the orifice and weir fishways (Case Study: Diversion Dam of Karkhe). Advances in Environmental Biology, 8(25)(Special):370-374.

Alishahi, M. 2010. Comparison of toxicity of two colloidal nanosilvers in *Barbus grypus*. Journal of Veterinary Pathobiology (Journal of Veterinary Modern Research), 1(4):9-16, 2. In Farsi.

Alishahi, M., Akbari, M., Jalali, M. R. and Nadaf, H. 2014. Effects of three anesthetics: MS222, clove oil and 2-phenoxyethanol on some haematological parameters and serum enzymes of *Cyprinus carpio*. Journal of Utilization and Cultivation of Aquatics, 3(1):105-120. In Farsi.

Alishahi, M., Cheshmeh, B., Peyghan, R., Ghorbanpour, M. and Mohamadian, T. 2014. Effects of anesthesia with MS222, eugenol and 2-phenoxyethanol on some immune parameters of *Cyprinus carpio*. Journal of Wetland Ecobiology, 5(4):23-32. In Farsi.

Alishahi, M., Esmaeili Rad, A., Zarei, M. and Ghorbanpour, M. 2014. Effect of dietary chitosan on immune response and disease resistance in *Cyprinus carpio*. Iranian Journal of Veterinary Medicine, 8(2):125-133.

Alishahi, M., Ghorbanpour, M. and Peyghan, R. 2012. Effects of *Viscum album* Linnaeus and *Nigella sativa* Linnaeus extracts on some immune responses of common carp *Cyprinus carpio* Linnaeus. Asian Fisheries Science, 25(1):15-28.

Alishahi, M., Hajipoor, O., Ghorbanpoor, M. and Mesbah, M. 2018. Adjuvant effects of nanochitosan on immunogenicity of *Aeromonas hydrophila* vaccine in *Cyprinus carpio*.

Journal of Veterinary Research, 73(1):72-81. In Farsi.
Alishahi, M., Heidari, A. A., Gholamhosseini, A. and Najafzadeh, H. 2019. Study on anesthetic effects of ketamine and acepromazine in *Tor grypus*. Journal of Aquaculture Sciences, 5(2):12-21. In Farsi.
Alishahi, M., Heidari, B. and Mohammadian, B. 2014. Effects of toxic concentration of *Aloe vera* crude extract on haemato-immunological indices and histological changes in *Cyprinus carpio*. Journal of Fisheries, 7(4):73-84. In Farsi.
Alishahi, M., Masbah, M. and Tulabi Dezfuli, Z. 2018. Comparison of toxicity of silver nanoparticles in three fish species: *Cyprinus carpio*, *Ctenopharyngodon idella* and *Hypophthalmichthys molitrix*. Journal of Animal Environment, 10(1):179-184. In Farsi.
Alishahi, M. and Mesbah, M. 2010. Comparison of silver nanoparticle's toxicity in four fish species: *Ctenopharyngodon idella*, *Barbus grypus*, *Astronorus* (*sic*) *ocellatus* and *Cichlasoma severums* (*sic*). Journal of Marine Biology, 2(3):45-51. In Farsi.
Alishahi, M. and Mesbah, M. 2012. Effects of *Viscum album* and *Nigella sativa* extracts on survival rate, growth factors and resistance to *Aeromonas hydrophila* infection in gold fish (*Carassius auratus*). Journal of Veterinary Research, 67(3):285-290. In Farsi.
Alishahi, M., Mesbah, M., Najafzadeh, M. and Ghorbanpoor, M. 2009. Effects of *Silybum marianum* on resistance against *Aeromonas hydrophila* infection in *Cyprinus carpio*. 13th European Congress of Ichthyology, 6-12 September 2009, Klaipeda, Lithuania (abstract).
Alishahi, M., Mesbah, M. and Shirali, T. 2017. Comparison of oral and parenteral injection administration of *Echinacea purpurea* on some immunological and hematological parameters of grass carp (*Ctenopharyngodon idella*). Journal of Veterinary Research, 72(2):251-259. In Farsi.
Alishahi, M., Mohammadi, A., Mesbah, M. and Razi Jalali, M. 2016. Haemato-immunological responses to diazinon chronic toxicity in *Barbus sharpeyi*. Iranian Journal of Fisheries Sciences, 15(2):870-885.
Alishahi, M. and Peyghan, R. 2008. Report of a severe and scarce infection to *Lernaea cyprinacea* in bighead *Hypophthalmichthys nobilis*. Iranian Veterinary Journal, 4(2)(19):122-128. In Farsi.
Alishahi, M., Pourmehdi Borujeni, M. and Abdi, E. 2013. Comparison of effects of some immunostimulants and medicinal plants extract on growth rate and resistance against environmental stressors in *Barbus barbulus*. Iranian Veterinary Journal, 8(4)(37):59-67. In Farsi.
Alishahi, M., Ranjbar Mohammad, M., Ghorbanipour, M., Peyghan, R., Mesbah, M. and Razi Jalali, M. 2010. Effects of dietary *Aloe vera* on some specific and nonspecific immunity in the common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Medicine, 4(3):189-195.
Alishahi, M., Soltani, M., Mesbah, M. and Esmaeilli Rad, A. 2011. Effects of dietary *Silybum marianum* extraction immune parameters of the common carp (*Cyprinus carpio*). Journal of Veterinary Research, 66(3):255-263. In Farsi.
Alishahi, M., Soltani, M., Mesbah, M. and Zargar, A. 2012. Immunostimulatory and growth stimulation effects of Ergosan, Levamisole and herbal extracts in *Cyprinus carpio*. Journal of Veterinary Research, 67(2):135-142. In Farsi.
Alishahi, M., Soltani, M. and Zargar, A. 2009. Bacteriological study of grass carp (*Ctenopharyngodon idella*) mortality in Khuzestan Province. Iranian Veterinary Journal, 4(5)(22):25-34. In Farsi.

Alishahi, M., Tollabi, M. and Ghorbanpoor, M. 2019. Comparison of the adjuvant effect of propolis and Freund on the efficacy of *Aeromonas hydrophila* vaccine in common carp (*Cyprinus carpio*). Iranian Journal of Fisheries Sciences, 18(3):428-444.

Alishahi, M., Tulaby Dezfuly, Z. and Mesbah, M. 2018. Effects of alcoholic and aqueous extract of propolis on growth performance, hemato-immunological parameters and disease resistance of common carp (*Cyprinus carpio*). Turkish Journal of Fisheries and Aquatic Sciences, 18(11):1245-1254.

Alishahi, M., Tulaby Dezfuly, Z. and Mohammadian, T. 2016. Acute toxicity evaluation of five herbicides: paraquat, 2,4-dichlorophenoxy acetic acid (2,4-D), trifluralin, glyphosite and atrazine in *Luciobarbus esocinus* fingerlings. Iranian Journal of Veterinary Medicine, 10(4):319-330.

Alishahi, M., Tulaby Dezfuly, Z., Mohammadian, T. and Mesbah, M. 2018. Effects of two probiotics, *Lactobacillus plantarum* and *Lactobacillus bulgaricus* on growth performance and intestinal lactic acid bacteria of *Cyprinus carpio*. Iranian Journal of Veterinary Medicine, 12(3):207-218.

Alishahi, M., Tulaby Dezfuly, Z. and Osroosh, E. 2018. Investigation the effect of penicillamine and EDTA on toxicity of silver nanoparticles in *Tor grypus*. Journal of Wetland Ecobiology, 10(3):103-112. In Farsi.

Alivand Darani, Z. and Chamani A. 2020. Water quality assessment of Zayandeh-rood River based on diversity and abundance of macrobenthos in 2017. Experimental Animal Biology, 8(4):97-107. In Farsi.

Aliyev, D. S., Sukhanova, A. I. and Shakirova, F. M. 1988. Fishes of the inland waters of Turkmenistan. Ylym, Ashkhabad. 142 pp., 11 pls. In Russian.

Alizade Govarchin Ghale, Y., Alunkaynak, A. and Unal, A. 2018. Investigation anthropogenic impacts and climate factors on drying up of Urmia Lake using water budget and drought analysis. Water Resources Management, 32(1):325-337.

Alizadeh, H. 2004. Introduction to the Features of the Caspian Sea. Norbakhsh Publications, Tehran. 120 pp.

Alizadeh, M., Patimar, R., Abdoli, A., Farhangi, M. and Adineh, H. 2014. Investigation of age structure and growth characteristics of chub *Squalius cephalus* (Linnaeus, 1758) in the southern Caspian basin. Journal of Experimental Animal Biology, 2(4):15-25. In Farsi.

Alizadeh, M., Patimar, R., Abdoli, A., Farhangi, M. and Golzarianpour, K. 2015. A study on morphological variation of chub, *Leuciscus orientalis*, (Nordmann, 1840) in the southern Caspian Sea basin. Journal of Animal Environment, 7(1):217-228. In Farsi.

Alizadeh Doughikollaee, E., Sayyad, M. and Nourzaei, K. 2016. Effects of edible whey protein coating and essential oil of *Anethum graveolens* on the quality of *Hypophthalmichthys molitrix* fillet during refrigerated storage. Journal of Fisheries Science and Technology, 5(2):87-98. In Farsi.

Alizadeh Marzenaki, A., Shojaei Kavan, L., Taghiyan, H. and Shahriari, R. 2016. A survey of biodiversity and distribution of fish in Gavehrud of Kermanshah Province. Breeding and Aquaculture Sciences Quarterly, 4(8):69-84. In Farsi.

Alizadeh Osalou, Z., PourAzari, A. M., NekuleFard, A., Seidgar, M., Yahyazadeh, M., Shiri, S. and Alizadeh Kalahsani, M. 2015. The study of water quality fluctuations of Aras Reservoir. Journal of Wetland Ecobiology, 7(1):5-14. In Farsi.

Alizadeh Sabet, H. R. 2003a. A limnology study on Ghalehroodkhan River, Guilan Province, Iran. World Aquaculture 2003, 20-23 May, Salvador, Brazil (title).

Alizadeh Sabet, H. R. 2003b. Identification of Jarahee River fishes in Kohguilouye & Boyerahmad and Khouzestan provinces. Iranian Scientific Fisheries Journal, 12(1):63-76, 5. In Farsi.

Alizadeh Sabet, H. R. 2017a. Feasibility study of Tehran province water resources for fish production - Phase 1: Salehabad Qanat. Iranian Fisheries Science Research Institute, Tehran. 56 pp. In Farsi.

Alizadeh Sabet, H. R. 2017b. Trout farms and other human activities effects on Cheshmehkileh river ecosystem in Tonekabon. Iranian Fisheries Science Research Institute, Tehran. 138 pp. In Farsi.

Al-Jubouri, M. O. A. 2019. Biological aspects of five fish species in the Al-Diwania River, Al-Kadesia Province, Iraq. Ph.D. Thesis, University of Basrah. 214 pp. In Arabic.

Al-Jubouri, M. O. A. and Mohamed, A-R. M. 2019. Some biological aspects of Al-Shabbot *Arabibarbus grypus* (Heckel, 1843) in Al-Diwanyia River, middle of Iraq. Journal of University of Babylon for Pure and Applied Sciences, 27(2):306-316. In Arabic.

Alkahem, H. F. and Behnke, R. J. 1983. Freshwater Fishes of Saudi Arabia. Fauna of Saudi Arabia, 5:545-567.

Alkan Uçkun, A. and Gökçe, D. 2015a. Assessing age, growth and reproduction of *Alburnus mossulensis* and *Acanthobrama marmid* (Cyprinidae) populations in Karakaya Dam Lake (Turkey). Turkish Journal of Zoology, 39(1):1-14.

Alkan Uçkun, A. and Gökçe, D. 2015b. Growth and reproduction of *Cyprinion macrostomus* (Heckel, 1843) and *Cyprinion kais* (Heckel, 1843) populations in Karakaya Dam Lake (Euphrates River), Turkey. Turkish Journal of Zoology, 39(4):685-692.

Al-Khashab, W. H. 1958. The water budget of the Tigris and Euphrates basin. University of Chicago, Department of Geography, Research Paper, 54:ix + 105 pp., 3 maps.

Allahyari, M. S. 2010. Social sustainability assessment of fishery cooperatives in Guilan Province, Iran. Journal of Fisheries and Aquatic Sciences, 5(3):216-222.

Allahyari, M. S. 2016. Information seeking behaviour of carp farmers in Sangars area of Rasht Township, Guilan Province. Journal of Utilization and Cultivation of Aquatics, 4(4):15-27. In Farsi.

Allouse, S. B., Khalaf, A. N. and Al-Jafary, A. 1986. Some biological aspects of *Chondrostoma regius* (*sic*) (Heckel) - (Cyprinidae: Cypriniformes) in Diyala River (Baghdad-Iraq). Journal of Biological Sciences Research, Baghdad, 17(1):227-239.

Almaça, C. 1981. La collection de *Barbus* d'Europe du Muséum national d'Histoire naturelle (Cyprinidae, Pisces). Bulletin du Muséum national d'Histoire naturelle, Paris, 4e série, 3, section A, numéro 1:277-307.

Almaça, C. 1983. Remarks on some Heckel's species of *Barbus* from western Asia. Arquivos do Museu Bocage, B, II(12):95-102.

Almaça, C. 1984a. Notes on some species of western Palearctic *Barbus* (Cyprinidae, Pisces). Arquivos do Museu Bocage, C, II(1):1-76.

Almaça, C. 1984b. Form relationships among western Palearctic species of *Barbus* (Cyprinidae, Pisces). Arquivos do Museu Bocage, A, II(12):207-248.

Almaça, C. 1985. Morphological relationship and evolutionary rate of taxonomic characters in Euro-Mediterranean *Barbus* (Cyprinidae, Pisces). Arquivos do Museu Bocage, B, II(16):129-136.

Almaça, C. 1986. On some BARBUS species from Western Asia (Cyprinidae, Pisces). Annalen des Naturhistorischen Museums in Wien, 87B:5-30.

Almaça, C. 1988. Remarks on the biogeography of Euro-Mediterranean *Barbus* (Cyprinidae, Pisces). Bulletin d'Ecologie, 19(2-3):159-162.

Almaça, C. 1990. Neogene circum-Mediterranean paleogeography and Euro-Mediterranean *Barbus* biogeography. Arquivos do Museu Bocage, nova série, 1(41):585-611.

Almaça, C. 1991. Evolutionary, biogeographical, and taxonomical remarks on Mesopotamian species of *Barbus s.s.* Arquivos do Museu Bocage, nova série, 2(4):63-78.

Almaça, C. 1992. A tentative key to the species of Euro-Mediterranean *Barbus* (Cyprinidae, Pisces). Garcia de Orta, Série de Zoologia, Lisboa, 16(1-2)(1989):25-30.

Almaça, C. 1994. Studies on taxonomy, biogeography, and speciation in Euro-Mediterranean Barbus (*Barbus s.s.*). Arquivos do Museu Bocage, nova série, 2(28):455-462.

Almasi, H., Takdastan, A., Jaafarzadeh, N., Akbar Babaei, A., Tahmasebi Birgani, Y., Cheraghian, B., Saki, A. and Jorfi, S., 2020. Spatial distribution, ecological and health risk assessment and source identification of atrazine in Shadegan international wetland, Iran. Marine Pollution Bulletin, 160:111569.

Al-Mehdi, M. I. A. and Khan, A. A. 1984. Haematology of a freshwater carp *Cyprinion macrostomus* from northern Iraq. Environment & Ecology, 2(3):222-226.

Al Mukhtar, M. A. 2009. Propagation planning and hatchery construction for bunnei (*Barbus sharpeyi*, Gunther, 1874) in Basra-Iraq. Mediterranean Aquaculture Journal, 2(1):1-7.

Al-Mukhtar, M. A. and Al-Hassan, L. A. J. 1999. A natural intergeneric hybrid of *Barbus sharpeyi* (Günther, 1874) and *Carassius auratus* (L.) from a small water body in Khoozestan (Iran) Acta Zoologica Bulgarica, 51(1):35-41.

Al Mukhtar, M. A., Al Noor, S. S. and Saleh, J. H. 2006. General reproductive biology of bunnei (*Barbus sharpeyi* Gunther, 1874) in Al Huwaizah Marsh, Basra-Iraq. Turkish Journal of Fisheries and Aquatic Sciences, 6(2):149-153.

Al-Nasih, M. H. 1992. Preliminary observations related to the culture of *Barbus sharpeyi* (bunni). Journal of Aquaculture in the Tropics, 7(1):69-78.

Al-Nasiri, S. K. 1991. On the biology of Cyprinion macrostomus (Heckel) in Tigris River. Basrah Journal of Agricultural Sciences, 4(1-2):189-198. In Arabic.

Al-Nasiri, S. K. and Dawood, A. H. 1991. The biology of reproduction of common carp in Hor Al-Hammar, southern, (*sic*) Iraq. Iraqi Journal of Science, 32(2):443-451.

Al-Nasiri, S. K. and Hoda, S. M. S. 1975. Survey of fish fauna of Shatt-Al-Arab (from Abu-al-Khasib to Karmat Ali). Bulletin of the Basrah Natural History Museum, 2:36-46.

Al-Nasiri, S. K. and Hoda, S. M. S. 1976. A guide to the freshwater fishes of Iraq. Basrah Natural History Museum Publication, 1:xii + 124 pp.

Al-Nasiri, S. K., Jawad, L. A. J., Al-Salami, M. A. and Marina, B. A. 1975. Biometric studies on *Aspius vorax* Heckel from Basrah waters. Bulletin of the Basrah Natural History Museum, 2:59-67.

Al-Nasiri, S. K. and Salman, N. A. 1977. Length-weight relationship and condition of **Acanthobrama marmid** Heckel, in the Lesser Zab River. Iraqi Journal of Agricultural Science, 12:186-194.

Al-Noor, S. S. 2010. Population status of gold fish *Carassius auratus* in restored East Hammar Marsh, southern Iraq. Journal of King Abdulaziz University, 21(1):65-83.

Al-Noor, S. S., Al Mukhtar, M. A., Salman, N. A. and Ali, M. H. 2012. Improvement of the induced spawning of bunnei (*Barbus sharpeyi*, Gunther, 1874) (*sic*) in Iraqi hatcheries. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-

12 December 2012, Karaj, Iran, pp. 485-495.

Alp, A. and Balik, S. 2000. Growth conditions and stock analysis of the carp (*Cyprinus carpio*, Linnaeus 1758) population in Gölhisar Lake. Turkish Journal of Zoology, 24(3):291-304.

Al-Rawi, A. H., Al-Obaidi, S. and Jawdat, S. Z. 1978. A list of fishes collected from the Little Zab River in Iraq: 1. Bulletin of the Biological Research Centre, Baghdad, 10:3-12.

Al-Rudainy, A. J. 2008. Atlas of Iraqi Fresh Water Fishes. Ministry of the Environment, Baghdad. 107 pp. In English and Arabic.

Al-Rudainy, A. J., Al-Nasiri, S. K. and Hussain, T. S. 2004. Natural food of gattan *Barbus xanthopterus* in man-made lake, west of Baghdad. Marina Mesopotamica, 19(2):257-266. In Arabic.

Al-Saadi, H. A. and Arndt, E. A. 1973. Some investigations about the hydrographical situation in the lower reaches of Shatt Al-Arab and the Arabian Gulf. Wissenschaftliche Zeitschrift der Universität Rostock Mathematisch-Naturwissenschaftliche, 22(10):1169-1174.

Al-Saadi, H. A., Arndt, E. A. and Hussain, N. A. 1975. A preliminary report on the basic hydrographical data in the Shatt Al-Arab estuary and the Arabian Gulf. Wissenschaftliche Zeitschrift der Universität Rostock Mathematisch-Naturwissenschaftliche, 24(6):797-802.

Al-Saadi, H. A., Hadi, R. A. M., Schiewer, U. and Al-Mousawi, A. H. 1989. On the influence of the sewage drainage from Basrah city on the phytoplankton and related nutrients in the Shatt al-Arab estuary, Iraq. Archiv für Hydrobiologie, 114(3):443-452.

Al-Sabti, K. 1986. Karyotypes of *Cyprinus carpio* and *Leuciscus cephalus*. Cytobios, 47(188):19-25.

Al-Sahaf, M. 1975. Chemical composition of the water resources of Iraq. Vodnye Resursy, 4:173-185. In Russian. (Water Resources, 4(1976):677-687. In English).

Al-Saleh, F., Hammoud, V., Hussein, A. and Alhazzaa, R. 2012. On the growth and reproductive biology of asp, *Aspius vorax*, population from the middle reaches of Euphrates River. Turkish Journal of Fisheries and Aquatic Sciences, 12(1):149-156.

Al-Sayari, S. S. and Zötl, J. G. (Eds.). 1978. Quaternary Period in Saudi Arabia. Volume 1: Sedimentological, hydrogeological, hydrochemical, geomorphological, and climatological investigations in central and eastern Saudi Arabia. Springer-Verlag, Wien. xi + 335 pp.

Al-Shamma'a, A. A. 2004. Fish collection from Al-Hammar Marsh in southern Iraq. Iraqi Journal of Sciences and Technology, 1(1):120-123.

Al-Shamma'a, A. A., Al-Mashhadany, A. J., Alasha'ab, M. H. and Nasser, E. N. 2009. Natural feeding of fish from Habbanyia Lake 3 - Kattan (*Barbus* (*Luciobarbus*) *xanthopterus* (Heckel 1843). Iraqi Journal of Agriculture (Special Issue), 14(1):170-176. In Arabic.

Al-Shamma'a, A. A. and Jasim, Z. M. 1993. The natural food of *Liza abu* during the flood in Al-Hammar Marsh, south Iraq. Zoology in the Middle East, 9(1):59-64.

Al-Shamma'a, A. A., Mohammad, M. A. and Al-Mashhadany, A. J. 1999. The natural food of fish from Al-Qadisiya Reservoir. 2 - Kattan *Barbus xanthopterus* and other *Barbus* species. Dirasat Pure Sciences, 26(1):137-149. In Arabic.

Al-Shamma'a, A. A., Mohammad, M. A. and Hammady, A. J. 1996. The natural food of fish from Al-Qadisiya Reservoir. 1 - Common carp *Cyprinus carpio* L. Dirasat Agricultural Sciences, 23(2):143-150. In Arabic.

Al-Shamma'a, A. A., Shawardy, A. O., Hassan, A. F. and Nashaat, M. R. 2009. Natural diet of four fish species from the Euphrates River at Ash-Shamiyah, Iraq. Alanbar University

Journal for Pure Science, 3(3):74-82. In Arabic.
Altındag, A., Ozkurt, S., Yigit, S. and Ahıska, S. 1998. The growth features of tench (*Tinca tinca* L., 1758) in Kesikköprü Dam Lake. Turkish Journal of Zoology, 22(4):311-318.
Altindağ, A., Shaha, S. L. and Yiğit, S. 2002. The growth features of tench (*Tinca tinca* L., 1758) in Bayındır Dam lake, Ankara, Turkey. Turkish Journal of Zoology, 26(4):385-391.
Altindağ, A., Yiğit, S., Ahiska, S. and Özkurt, Ş. 2002. The growth features of tench (*Tinca tinca* L., 1758) in Kesikköprü Dam lake, Ankara, Turkey. Turkish Journal of Zoology, 22(4):311-318.
Alwan, N. 2010. Systematics, taxonomy, phylogeny and zoogeography of the *Capoeta damascina* species complex (Pisces: Teleostei: Cyprinidae) inferred from comparative morphology and molecular markers. Dissertation zur Erlangung des Doktorgrades der Naturwissenschaften, Johan Wolfgang Goethe-Universität in Frankfurt am Main. xix + 264 pp.
Alwan, N., Esmaeili, H-R. and Krupp, F. 2016. Molecular phylogeny and zoogeography of the *Capoeta damascina* species complex (Pisces: Teleostei: Cyprinidae). PLoS ONE, 11(6):e0156434.
Alwan, N. H., Zareian, H. and Esmaeili, H. R. 2016. *Capoeta coadi*, a new species of cyprinid fish from the Karun River drainage, Iran based on morphological and molecular evidences (Teleostei, Cyprinidae). ZooKeys, 572:155-180.
Alyan, F. 2010. Iran's northern fishing industry wanes. http://iwpr.net, downloaded 2 June 2011.
Amaninejad, P., Hosseinzadeh Sahafi, H., Soltani, M., Kamali, A. and Naji, T. 2018. Effects of endocrine disruption by 4-nonylphenol ethoxylate on the growth performance and immune response of female and male immature koi carp (*Cyprinus carpio carpio*). Iranian Journal of Fisheries Sciences, 17(4):725-744.
Amanov, A. A. 1970. Morphology and ecology of the Samarkand khramulya [*Varicorhinus capoëta heratensis* (Kessl.)] of the Surkhan Dariya River basin. Journal of Ichthyology, 10(4):475-481.
Amanov, A. A. 1972. Morphology and mode of life of the Turkestan gudgeon [*Gobio gobio lepidolaemus* (Kessler)] from the Surkhandar'ya Basin. Journal of Ichthyology, 12(4):601-608.
Amarloo, J., Esmaili Sari, A. and Bahramifar, N. 2015. Determination of allowable consumption rate of important fish species in Anzali Wetland based on mercury content in muscle tissue. Journal of Animal Environment, 6(4):249-255. In Farsi.
Ameri Siahouei, R., Zaeimdar, M., Moogouei, R. and Jozi, S. A. 2020. Surveying riparian zone and water quality of Jajrud River. Iranian Journal of Aquatic Animal Health, 6(1):29-43.
Amini, A. and Qishlaqi, A. 2020. Spatial distribution, fractionation and ecological risk assessment of potentially toxic metals in bottom sediments of the Zarivar freshwater lake (Northwestern Iran). Limnologica, 84:125814.
Amini, K. 2006. Study on quantity and quality of released kutum fingerling into the Mazandaran rivers. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).
Amini, S. and Ahmadi Nadoushan, M. 2020. Monitoring of trophic state in Amirkeyaleh Wetland in order to management and protection. Journal of Animal Environment, 11(4):345-350. In Farsi.
Amini, S., Biukani, S., Khalaji, M. and Sarkhosh, J. 2013. Identification of fishes from Gamasiab

River in Kermanshah Province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 11 (abstract).

Amini, S., Khalaji, M. and Sarkhosh, J. 2013. Relationship of some organic and ionic water parameters with hematological indices in common carp (Cyprinidae: *Cyprinus carpio*). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 12 (abstract).

Amini Khahan, Z., Gorgin, S., Shabanpour, B. and Yahyaei, M. 2018. Effects of *Rutilus kutum* mortality in gillnet on the quality and shelf life during refrigerated storage. Journal of Utilization and Cultivation of Aquatics, 7(3):29-39. In Farsi.

Amini Khahan, Z., Gorgin, S., Shabanpour, B. and Yahyaei, M. 2019. Effects of *Rutilus kutum* mortality on the appearance and sensory acceptability by gillnetting. Journal of Applied Ichthyological Research, 7(1):131-142. In Farsi.

Amini Rad, A. 2001. Community level survey to assess the importance of fisheries in a socio-economic context in Bandar Anzali. Caspian Environment Programme, Baku, Azerbaijan. 24 pp.

Amini Ranjbar, Gh. 1994. Heavy metal concentration in surficial sediments from Anzali wetland. Iranian Fisheries Scientific Journal, 3(3):5-26, 2. In Farsi.

Amini Ranjbar, Gh. 1998. Heavy metal concentration in surficial sediments from Anzali Wetland, Iran. Water, Air, and Soil Pollution, 104(3-4):305-312.

Aminian Fatideh, B., Golmohammadi Manjili, N., Shafiei Sabet, S., Vahdati, N. and Jafari, M. V. 2017. Impact of electric field exposure and salinity on behavior of common carp (*Cyprinus carpio*) during entanglement of fishing gear. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 29(4):100-108. In Farsi.

Aminian Fatideh, B., Hosseinzadeh Sahafi, H., Shaabani, A. and Yaghmaei, F. 2008. Reproduction characteristics of *Rutilus frisii kutum* in the southern coast of Caspian Sea. Pajouhesh va Sazandegi, 21(2)(79):144-152. In Farsi.

Aminian Fatideh, B., Hosseinzadeh Sahafi, H., Shaabani, A., Yaghmaei, F. and Shafiei Sabet, S. 2008. Determination of stages of sex maturity of *Rutilus frisii kutum* Kamenskii, 1901 in the Caspian Sea using biological indexes (*sic*). Journal of Science, Teacher Training University, 8(2):107-120. In Farsi.

Aminian Fatideh, B. and Pour Asadi, M. 2019. Organic aquaculture, determination of biotechnology of combined cultivation of warm water fish and poultry (integrate) in Gilan. New Technologies in Aquaculture Development (Journal of Fisheries), 13(2):33-39. In Farsi.

Aminian Fatideh, B. and Shafiei Sabet, S. 2011. Study on biological indices of bony fishes by two types of tensive net (beach seine) from southwestern coast of the Caspian Sea. Journal of Biology Science, 4(4)(series no. 15):15-27. In Farsi.

Aminipouri, B. 2002. Water policy development in I.R. of Iran. MS, 39 pp.

Amiri, A., Aghlmandi, F. and Binaye, M. 2007. Study on status of maturation and release of kutum fry fish in the southern Caspian Sea, Mazandaran Province. Journal of Animal and Aquaculture, 74:156-166.

Amiri, H., Shabanpour, B. and Rahmanifarah, K. 2015. Effect of ice storage duration of silver carp (*Hypophthalmichthys molitrix*) on qualitative properties of its surimi powder. Journal of Fisheries Science and Technology, 4(3):1-15. In Farsi.

Amiri, H., Shabanpour, B. and Rahmanifarah, K. 2016. Effects of frozen storage of silver carp (*Hypophthalmichthys molitrix*) on qualitative properties of surimi powder. Journal of

Fisheries Science and Technology, 4(4):19-34. In Farsi.
Amiri, M., Aberoumand, A. and Ziaee Nejad, S. 2019. Effects of *Beta vulgaris* powder on growth and survival of common carp *Cyprinus carpio*. Journal of Fisheries, 7(3):714-718.
Amiri, M. J. and Eslamian, S. S. 2010. Investigation of climate change in Iran. Journal of Environmental Science and Technology, 3(4):208-216.
Amiri, S. A., Khara, H. and Valipour, A. R. 2014. The effect of different levels canola meal on growth performance and body composition in *Rutilus frisii kutum* fingerlings. Journal of Marine Biology, 6(22):75-83. In Farsi.
Amiri, S. A., Sayad Bourani M., Moradi, M. and Pourgholami, A. 2008. The effect of water salinity on growth and survival of *Rutilus frisii kutum* fingerlings. Iranian Scientific Fisheries Journal, 17(1):23-30. In Farsi.
Amiri, Z. and Nahvi, M. 2016. Economic impact of rice-fish farming in paddy (a case study: Fouman, Astaneh-Ashrafieh and Rasht in Guilan Province. Cereal Research, 6(2):255-269. In Farsi.
Amirisendesi, S. A., Valipur, A. and Salavatian, S. M. 2017. Investigation different levels of canola meal analys body (*sic*) *Rutilus kutum* fingerlings. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Amirjanati, A., Norouzi, M. and Nazemi, A. 2013. Population genetic structure of common carp (*Cyprinus carpio* Linnaeus 1758) in Anzali Wetland and Gorganrud estuary using microsatellite markers. Journal of Aquaculture Development, 7(3):1-10. In Farsi.
Amirkolaie, A. K. 2008. Environmental impact of nutrient discharged by aquaculture waste water on the Haraz River. Journal of Fisheries and Aquatic Science, 3(5):275-279.
Amirnejad, H. and Heidari Kamalabadi, R. 2015. Affective factors on fish consumption pattern in households (Case study: Sari). Iranian Scientific Fisheries Journal, 24(3):165-177. In Farsi.
Amouei, F. and Abdovali, H. 2014. Determining age and morphology of *Aspius Aspius* (*sic*) *taeniatus* (Mung fish) using otolith in south basin of Caspian Sea. Journal of Applied Environmental and Biological Sciences, 4(1):140-146.
Amouei, F., Abdovali, H. and Valinassab, T. 2013. Aging and morphology of otolith in *Barbus bracycephalus* (*sic*) *caspius* and *B. capito* in the southern Caspian Sea. Annals of Biological Research, 4(6):337-344.
Amouei, F., Valinassab, T. and Haitov, A. 2013. Age determination and morphological study using otoliths in *Cyprinus carpio* Linnaeus, 1758 in the southern Caspian Sea. Iranian Journal of Fisheries Sciences, 12(4):759-769.
Amouei, F., Valinassab, T. and Haitov, A. 2014. Aging and morphology of otolith in *Alburnus chalcoides* (Guldenstaedt, 1772) in the southern Caspian Sea. Caspian Journal of Environmental Sciences, 12(2):205-214.
Amouii, M., Saemi-Komsari, M. and Mousavi-Sabet, H. 2016. Biology and spawning time of the *Squalius cephalus* from Sefidrood River, northern Iran. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).
Amouii, M., Saemi-Komsari, M. and Mousavi-Sabet, H. 2017. Population structure and condition factors of the *Alburnoides samiii* in the southwest Caspian Sea basin. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Anan, Y., Kunito, T., Tanabe, S., Mitrofanov, I. and Aubrey, D. G. 2005. Trace element

accumulation in fishes collected from coastal waters of the Caspian Sea. Marine Pollution Bulletin, 51(8-12):882-888.

Andarz, B., Kamali, A., Avakh Keysami, M. and Rajabi Eslami, H. 2020. Genetic diversity of the two populations of common cultured common carp (*Cyprinus carpio*) in Guilan and Mazandaran provinces using ten microsatellite markers. Journal of Animal Environment, 12(1):285-292. In Farsi.

Anderson, S. C. 2002. An introduction to the literature of the vertebrate zoology of Iran. Zoology in the Middle East, 26(1):15-28.

Anderson, T. S. 1880. My Wanderings in Persia. James Blackwood & Co., London. xii + 364 pp., map.

Andersskog, B. 1970. Report to the Government of Iran on fisheries activities in Iran with particular reference to the northern fisheries company. Food and Agriculture Organization, Rome, United Nations Development Programme, Technical Assistance, UNDP (TA) 2878:v + 18 pp.

Annandale, N. 1919a. Geographical introduction. Records of the Indian Museum, 18:3-16, pl. I-II.

Annandale, N. 1919b. Notes on the fish of the genus *Discognathus* from India and Persia. Records of the Indian Museum, 18:65-78, pl. IX-XI.

Annandale, N. 1921. The aquatic fauna of Seistan. A summary. Records of the Indian Museum, 18:235-253.

Annandale, N. and Hora, S. L. 1920. The fish of Seistan. Records of the Indian Museum, 18(4):151-203, pls. XV-XVII (includes:- Appendix. Note on the fisheries of the delta of the Helmand and on the use of shaped rafts of bulrushes in India and Seistan, by N. Annandale).

Annandale, N. and Hora, S. L. 1921. The fish of Seistan. Proceedings of the Seventh Indian Science Congress, Calcutta, p. lxxxiii.

Anonymous. 1877. Persian fisheries. Forest and Stream, 9:249-250.

Anonymous. 1905a. Eminent living geologists: William Thomas Blanford. Geological Magazine, New Series, Decade V, 2(1):1-15, 1 pl.

Anonymous. 1905b. William Thomas Blanford, C.I.E., LL.D., F.R.S., and Lieut. Sutton Aylmer Davies. The Ibis, 5(Eighth Series):643-647.

Anonymous. 1925. Obituary. Nelson Annandale, 1876-1924. Journal of the Bombay Natural History Society, 30(1 & 2):213-214.

Anonymous. 1961. Iran. Salient features, pp. 19-39. In: Multiple-purpose river basin development. Part 2D. Water resources development in Afghanistan, Iran, Republic of Korea and Nepal. United Nations Economic Commission for Asia and the Far East, Bangkok.

Anonymous. 1963. Decrease in water in the Caspian Sea and the means to overcome this. Game and Nature, Tehran, 43:8-14. In Farsi.

Anonymous. 1970a. Introductions of fish and shrimps. Food and Agriculture Organization, Rome, Fish Culture Bulletin, 2(3):16.

Anonymous. 1970b. Chinese carps in Iran. Food and Agriculture Organization, Rome, Aquaculture Bulletin, 3(1):15.

Anonymous. 1971. The Wetlands and Waterfowl of Iran. The Game and Fish Department of Iran, Tehran. 43 pp., 3 figs.

Anonymous. 1976. The blind white fish of Persia. Nature, London, 264:113-114.

Anonymous. 1977. Sport fishing in Iran.... Homa, Iran Air In-Flight Magazine, September-October, pp. 18-21.
Anonymous. 1977-1978. A survey of game laws and regulations in Iran. Department of the Environment, Tehran. 22 pp.
Anonymous. 1988a. National Parks on the Threatened List. Species, Newsletter of the Species Survival Commission, IUCN, 10:25.
Anonymous. 1988b. The lingering death of the Caspian Sea. New Scientist, 118(1611):26.
Anonymous. 1989. Mullah fish. The Economist, 313(7631):86.
Anonymous. 1991a. The one that didn't get away. Seafood Business, 10(1):36.
Anonymous. 1991b. Plans of the Iranian Fisheries Company regarding utilization of the aquatic resources of the country. Abzeeyan, Tehran, 2:37-39. In Farsi.
Anonymous. 1991c. Introduction to Lurestan Fish Culture Company. Abzeeyan, Tehran, 2:58-59. In Farsi.
Anonymous. 1992a. Iran 21 years on. Newsletter of the Convention on Wetlands, 12:1.
Anonymous. 1992b. Status of fish culture in Chahar Mahal va Bakhtiari Province. Abzeeyan, Tehran, 2:52-53. In Farsi.
Anonymous. 1992c. Iranian fisheries in a glance. Abzeeyan, Tehran, 3:52-55. In Farsi.
Anonymous. 1993a. A river in the desert. Discover, 14(7):10.
Anonymous. 1993b. Opening day of the first closed system fish culture plan in Iran. Abzeeyan, Tehran, 4(9):52-53. In Farsi.
Anonymous. 1994. Report of a new cyprinid fish in Gilan rivers. Scientific Newsletter of the Iranian Fisheries Research and Training Organization, pp. 12-13. In Farsi.
Anonymous. 1996a. Inland fisheries in Kermanshah: a natural favourable capacity for development. Abzeeyan, Tehran, 7(1):11-13. In Farsi.
Anonymous. 1996b. Hidden treasures in the Iranian rivers. Shekar-o Tabiat, Tehran, (42):31. In Farsi.
Anonymous, 1996c. Annual report of aquaculture production in Iran. Shilat, Tehran. 120 pp. In Farsi.
Anonymous. 1997a. Islamic Republic of Iran. FAO Aquaculture Newsletter, 17:23.
Anonymous. 1997b. Iranian minister urges transfer of fisheries to private sector. WorldFish Report, 51:FS/5.
Anonymous. 1997c. The Ramsar Commission on Wetlands. Ramsar Advisory Missions: Report No. 37, Islamic Republic of Iran. 28 pp.
Anonymous. 1997d. Iran develops farm skills to meet fishing needs. Fish Farming International, 24(5):26-27.
Anonymous. 1997e. Iran goes private! - Moving fisheries out of state control. Fish Farming International, 24(5):38.
Anonymous. 1997f. Annual report of aquaculture production in Iran. Shilat, Tehran. 135 pp. In Farsi.
Anonymous. 1998a. Iranian exports. Seafood International, 13(11):7.
Anonymous. 1998b. Annual report of aquaculture production in Iran. Shilat, Tehran. 168 pp. In Farsi.
Anonymous. 2000. National Report of Islamic Republic of Iran for the Convention on Biological Diversity, Draft. Department of Environment, Tehran. 40 pp. (www.abdnet.com/doe/Projects/NBSAP/C_Report/country%20Report(Rev33).htm, downloaded 7 June 2000).

Anonymous. 2001a. Drought in Iran. Careless in a dry country. The Economist, July 28th-August 3rd, 2001, p. 48.
Anonymous. 2001b. Report of aquaculture production in Iran. Shilat, Tehran. 8 pp. In Farsi.
Anonymous. 2002. Report of aquaculture production in Iran. Shilat, Tehran. 98 pp. In Farsi.
Anonymous. 2003. Water crisis threatens the capital. Gostaresh-e Sannat, Tehran, 7:7 pp. (www.netiran.com/Htdocs/WeeklyJournal/Social/wj01503.html, downloaded 23 September 2003).
Anonymous. 2007. Doctor fish. New Scientist, 195(2612):52.
Anoosheh, K. S. and Aliasghar, K. 2009. Caspian Sea fisheries of Iran. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 81 (abstract).
Anousheh, N., Hosseinie, S. V., Mirsadeghi, H. and Shahhosseini, G. 2015. Effect of delayed icing of common carp (*Cyprinus carpio*) on the quality of produced surimi. Journal of Fisheries Science and Technology, 4(2):1-9. In Farsi.
Ansari, H. 2003. Fishing status in Shadegan Wetland. Southern Iran Aquaculture Fishery Research Centre, Ahvaz. 85 pp. In Farsi.
Ansari, H. 2016. Determination of biomass of fishes in Shadegan Wetland. Iranian Fisheries Science Research Institute, Tehran. 42 pp. In Farsi.
Ansari, H., Hashemi, S. A. R. and Eskandari, G. H. 2009. Survey of fishing status and biomass of fish in Shadegan Wetland. The 1st Scientific Conference of Iranian Wetlands, 3-4 March 2009, Ahvaz. p. 43. In Farsi.
Ansari, H. and Mohammadi, G. H. 2001. Capture fishing status in Shadegan Wetland. Southern Iran Aquaculture Fishery Research Centre, Ahvaz. 60 pp. In Farsi.
Ansari, M. and Akhoonzadeh, M. 2020. Mapping water salinity using Landsat-8 OLI satellite images (Case study: Karun basin located in Iran). Advances in Space Research, 65(5):1490-1502.
Ansari, M., Khodadadi, M., Peyghan, R. and Raissy, M. 2011. Influence of biometric characteristics and gender on serum IgM in the benni, *Barbus sharpeyi* Gunther, 1874 (Osteichthyes: Cyprinidae). Journal of Cell and Animal Biology, 5(6):105-108.
Ansari, M. and Raissy, M. 2011. Determination of copper, iron and zinc in the muscles of freshwater fish from Beheshtabad River. Global Veterinaria, 7(5):502-505.
Ansarifard, F., Rajabi Islami, H., Shamsaie Mehrjan, M. and Soltani, M. 2017. The effect of dietary supplement spirulina (*Arthrospira platensis*) on the immune system and blood biochemical factors of koi fish (*Cyprinus carpio carpio*). Iranian Scientific Fisheries Journal, 26(3):23-32. In Farsi.
Ansarifard, F., Rajabi Islami, H., Shamsaie Mehrjan, M. and Soltani, M. 2018. Effects of *Arthrospira platensis* on growth, skin color and digestive enzymes of koi, *Cyprinus carpio*. Iranian Journal of Fisheries Sciences, 17(2):381-393.
Ansarifard, F., Rajabi Islami, H., Shamsaie Mehrjan, M. and Soltani, M. 2020. Effect of dietary supplement spirulina (*Arthrospira platensis*) to feed on some growth parameters and the activities of antioxidant enzyme defense in koi fish (koi, *Cyprinus carpio*). Journal of Aquaculture Development, 14 (2):13-23. In Farsi.
Antoine, S. E. and Al-Saadi, H. A. 1982. Limnological studies on the polluted Ashar Canal and Shatt al-Arab River at Basrah (Iraq). Internationale Revue der Gesamten Hydrobiologie, 67(3):405-418.
Anvari, M., Rezaie, M. and Kim, S. M. 2013. Effects of previous gutting on biochemical changes and profile of long-chain polyunsaturated fatty acids in cold-smoked kutum (*Rutilus frisii*

kutum) stored at room temperature (25 ± 2C). Journal of Food Biochemistry, 37(6):742-747.

Anvarifar, H., Farahmand, H., Nematollahi, M. A., Rahmani, H., Karami, M. and Khalili, B. 2010. Impacts of Shahid Rajaii Dam on genetic variation and differentiation of siah mahi, *Capoeta capoeta gracilis*, in Tajan River using RAPD fingerprinting. Journal of Fisheries (Iranian Journal of Natural Resources), 63(3):211-223. In Farsi.

Anvarifar, H., Farahmand, H., Nematollahi, M. A., Rahmani, H., Karami, M. and Khalili, B. 2012. Association analysis between morphometric and RAPD markers in siah mahi, *Capoeta capoeta gracilis*, within Tajan River. Modern Genetics Journal, 7(2)(29):165-173. In Farsi.

Anvarifar, H., Farahmand, H., Rahmani, H., Nematollahi, M. A., Karami, M. and Akbarzadeh, A. 2013. Investigation of morphometric variation and differentiation siah mahi, *Capoeta capoeta gracilis*, in Tajan River. Iranian Journal of Biology, 25(4):517-535. In Farsi.

AnvariFar, H., Farahmand, H., Silva, D. M., Bastos, R. P., Khyabani, A. and AnvariFar, H. 2013. Fourteen years after the Shahid-Rajaei dam construction: an evaluation of morphometric and genetic differentiation between isolated up- and downstream populations of *Capoeta capoeta gracilis* (Pisces: Cyprinidae) in the Tajan River of Iran. Genetics and Molecular Research, 12(3):3465-3478.

AnvariFar, H., Keramat Amirkolaie, A., Pak Nezhad, H. and Ouraji H. 2019. Influence of dietary nucleotides on growth performance and stress resistance in kutum (*Rutilus kutum* Kamenskii, 1901). Iranian Journal of Fisheries Sciences, 19(4):1708-1727.

AnvariFar, H., Keramat-Amirkolaie, A., Kolangi-Miandare, H. and Ouraji, H. 2017a. Make resistant kutum, *Rutilus kutum*, using different levels of dietary nucleotides supplementation. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 375-379. In Farsi.

AnvariFar, H., Keramat-Amirkolaie, A., Kolangi-Miandare, H. and Ouraji, H. 2017b. Investigation the effects of dietary nucleotides on growth performance and stress responses in kutum (*Rutilus kutum*) fry. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 694-702. In Farsi.

AnvariFar, H., Khyabani, A., Farahmand, H., Vatandoust, S., AnvariFar, H. and Jahageerdar, S. 2011. Detection of morphometric differentiation between isolated up- and downstream populations of Siah Mahi (*Capoeta capoeta gracilis*) (Pisces: Cyprinidae) in the Tajan River, Iran. Hydrobiologia, 673(1):41-52.

Anvarifar, H., Mousavi-Sabet, H., Satari, M., Vatandoust, S., Khiabani, A. and AnavariFar, H. 2014. Occurrence and intensity of *Tracheliastes polycolpus* on *Capoeta capoeta gracilis* (Pisces: Cyprinidae) in Tajan River from the southeast of the Caspian Sea. European Journal of Zoological Research, 3(2):103-107.

Aqrawi, A. A. M. 2001. Stratigraphic signatures of climatic change during the Holocene evolution of the Tigris-Euphrates delta, lower Mesopotamia. Global and Planetary Change, 28(1-4):267-283.

Arab, D. and Tajrishi, M. 2016. Urmia Lake restoration program, pp. 120-128. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Arab, M. and Keivany, Y. 2017. Study on some growth characteristics of trout barb (*Capoeta trutta*) in Bushehr and Tigris basins. Journal of Utilization and Cultivation of Aquatics, 5(4):25-32. In Farsi.

Arab, M. and Keivany, Y. 2020. Geometric morphometric comparison of Mond trout barb

Capoeta mandica Bianco & Bănărescu, 1982 in the Bushehr basin. Journal of Applied Ichthyological Research, 8(2):1-8. In Farsi.

Arab, N. and Rajabi Islami, H. 2016. Analysis of social and educational incentives tend to aquaculture field among students of Islamic Azad University, Sciences and Research Branch and North Tehran Branch. Journal of Aquaculture Development, 10(1):103-116. In Farsi.

Arab, S. Z., Shabanpour, B., Pourashouri, P. and Rahmanifarah, K. 2017. Effects of different levels of fat and partial substitution of NaCl with KCl on quality and shelf life of silver carp (*Hypophthalmichthys molitrix*) sausage. Journal of Fisheries Science and Technology, 6(3):75-86. In Farsi.

Arabi, M. 2005. Metal ion-mediated oxidative stress is associated with increased cell membrane and DNA damage in carp gill suspensions. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', September 8-10, Shahr-e Kord, Iran (abstract).

Arabi, M. and Heydarnejad, M. S. 2002. Relative impact of metal ion contamination on functional capacity of gill cells in carp (*Cyprinus carpio* L.). Book of Abstracts, 27th World Veterinary Congress, September 25-29, 2002, Tunis-Tunisia (abstract).

Arabnejad, S., Afshari, A., Sheybak, H., Alizadehsargazi, A. and Najafi, T. 2016. Effect of repetitive sperm stripping on some sperm quality indicators of *Schizothorax zarudnyi*. Journal of Animal Environment, 7(4):227-232. In Farsi.

Arabnejad, S., Gharaei, A., Ghaffari, M. and Rahdari, A. A. 2014. The effects of ovaprim, hCG and pituitary extract on biochemical parameters of seminal plasma in the snow trout (*Schizothorax zarudnyi* Nikolskii, 1897). Journal of Animal Researches (Iranian Journal of Biology), 27(3):386-395. In Farsi.

Arabnejad, S., Gharaei, A., Ghaffari, M. and Rahdari, A. A. 2015. Investigation of sperm quality fluctuation of snow trout (*Schizothorax zarudnyi* Nikolskii, 1897) in response to hormonal inducing. Journal of Cellular and Molecular Researches (Journal of Biology), 27(4):611-617. In Farsi.

Arabnejad, S., Sourinejad, I., Afshari, A. and Rigii, M. 2016. Investigation of spermatological and biochemical parameters of seminal plasma in Sistan's loach (*sic*) *Schizothorax zarudnyi* Nikolskii, 1897. Aquatic Physiology and Biotechnology, 4(1):1-16. In Farsi.

Araghi Soureh, A. and Jalali Jafari, B. 2005. A study on monogenean parasites of fishes gills in Mahabad's river with introducing two new species for parasitic fauna of Iran. Pajouhesh va Sazandegi, 17(1)(66):39-45. In Farsi.

Arai, R. 2011. Fish Karyotypes. A Check List. Springer, Tokyo. v + 340 pp.

Aramoon, A., Alishahi, M. and Seifi Abad Shapouri, M. R. 2018. Immunogenicity evaluation of *Aeromonas hydrophila* biofilm vaccine on the fingerling common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(3):207-212. In Farsi.

Arani, M. M., Allameh, S. K., Esteky, A. A. and Danialy, S. R. 2003. Evaluation of particles abundance and digestion in silver carp *Hypophthalmichthys molitrix* gut. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).

Aras, N. M., Güneş, M., Bayır, A., Sirkecioğlu, A. N. and Haliloğlu, H. I. 2009. Tuzla Çayı ve Tercan Baraj Gölü'ndeki *Capoeta capoeta umbla* HECKEL, 1843'nın Bazı Biyo-Ekolojik Özellikleri ile Total Yağ ve Yağ Asitleri Kompozisyonlarının Karşılaştırılması (The comparison of total fat and fatty acid profiles with some bio-ecological features of *Capoeta capoeta umbla* HECKEL, 1843 living in Tuzla Stream and Tercan Dam Lake).

Ekoloji, 19(73):55-64.

Ariaei, P., Tavakolipour, H., Rezaei, M. and Elhamirad, A. 2013. Antimicrobial activity of methyl cellulose based edible film enriched with *Pimpinella affinis* oil on the *Hypophthalmichthys molitrix* fillet under refrigerator storage condition. Electronic Journal of Food Processing and Preservation, 5(1):13-26.

Ariyaee, M., Azadi, N. A., Majnoni, F. and Mansouri, B. 2015. Comparison of metal concentrations in the organs of two fish species from the Zabol Chahnimeh Reservoirs, Iran. Bulletin of Environmental Contamination and Toxicology, 94(6):715-721.

Arjagh, M. M. 2003. An overview of fisheries and research in Iran. Hook, Line and Thinker, 2003(4):10.

Arjmandi, R., Karbassi, A. and Moogouie, R. 2007. Environmental effects of aquaculture in Iran. Journal of Environmental Science and Technology, 9(2)(33):19-28. In Farsi.

Armantrout, N. B. 1966. Report on observations on streams along the Caspian Sea. Report to the Game and Fish Department, Tehran. MS.

Armantrout, N. B. 1968a. Seistan-Baluchistan trip report, 9-18 March, 1968. Report to the Game and Fish Department, Tehran. MS.

Armantrout, N. B. 1968b. Observations and recommendations on the fisheries of Iran. Final Report to the Game and Fish Department and South Shilot, Iran. MS.

Armantrout, N. B. 1969. The fishes of Iran, a preliminary checklist. Bander Enzeli, Iran. MS, 39 pp.

Armantrout, N. B. 1980. The freshwater fishes of Iran. Ph.D. Thesis, Oregon State University, Corvallis, Oregon. xx + 472 pp.

Armantrout, N. B. 1990. Fish distribution as influenced by aquatic habitat alteration and species introductions, pp. 199-206. In: Daniel, J. C. and Serrao, J. S. (Eds.). Conservation in developing countries: problems and prospects. Proceedings of the centenary seminar of the Bombay Natural History Society. Bombay Natural History Society / Oxford University Press, Bombay, Delhi, Calcutta, Madras. ix + 656 pp.

Armantrout, N. B. and Hosseinzadeh, H. 1967a. Report on trip to Caspian. Report to the Game and Fish Department, Tehran, 2 July MS; 5 August MS.

Armantrout, N. B. and Hosseinzadeh, H. 1967b. Report on trip to Mordab. Report to the Game and Fish Department, Tehran. MS.

Arndt, E. A. and Al-Saadi, H. A. 1975. Some hydrographical characteristics of the Shatt Al-Arab and adjacent areas. Wissenschaftliche Zeitschrift der Universität Rostock Mathematisch-Naturwissenschaftliche, 24(6):789-796.

Arnold, A. and Längert, H. 1995. Das Moderlieschen. *Leucaspius delineatus* Biologie, Haltung und Artenschutz. Die Neue Brehm-Bücherei (Band 623), Westarp Wissenschaften, Magdeburg und Spektrum Akademischer Verlag, Heidelberg, 623:121 pp.

Arshadi, A. and Mirdarharijani, J. 2018. Study on biological characteristics of snow trout *Schizothorax zarudnyi* (Nikol'skii, 1897) in Chah Nimeh reservoirs, Sistan and Baluchestan Province. Journal of Applied Ichthyological Research, 5(4):1-18. In Farsi.

Arshadi, A. and Soltanzade, Z. 2011. Technical and productivity assessment study of fish culture in reservoir pond in Sistan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 5(1):77-84. In Farsi.

Arzi, A., Hemmati, A. A. and Nazari Khorasgani, Z. 2011. Determination and comparison of the organochlorine pesticide residue levels among benni fish of Shadegan, Mahshahr and Susangerd cities, Khozestan Province in Iran. Jundishapur Journal of Natural

Pharmaceutical Products, 6(1):24-31.
Arzi, L., Khorasgani, Z. N. and Arzi, A. 2009. Comparison of the organochlorine pesticide residue levels among benni fish of Shadegan, Mahshahr and Susangerd cities, Khouzestan Province, Iran. Toxicology Letters, 189(supplement 1):S207.
Asadi, A., Fatemi, M., Eskandari, Gh. and Mohammadi, G. 2011. The study of fish assemblage in Howaizeh marshland in Iran. Journal of Wetland Ecobiology, 2(6):3-11. In Farsi.
Asadi, H. 2016. Estimation of sediment, organic carbon, and phosphorous loads from Pasikhan River into Anzali Wetland, Iran. International Journal of Environmental Protection, 6(1):129-133.
Asadi, H., Sattari, M. and Eagderi, S. 2014a. Fish diversity indices of the Siahrood River (Sefidrud River basin - Guilan Province). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Asadi, H., Sattari, M. and Eagderi, S. 2014b. Fish habitat requirements of spirlin fish (*Alburnoides eichwaldii*) Totkabon River (tributary of Sefidrud River) using generalized additive models (GAM). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Asadi, H., Sattari, M. and Eagderi, S. 2015. The determination factors underlying habitat selectivity and preference for black fish *Capoeta capoeta gracilis* (Keyserling 1891) in Siyahrud River (a tributary of Sefidrud River basin). Iranian Scientific Fisheries Journal, 23(3):1-10. In Farsi.
Asadi, H., Sattari, M. and Eagderi, S. 2016. Habitat suitability index of *Barbus cyri* (Heckel, 1843) in Tootkabon River, the South Caspian Sea basin, Iran. Caspian Journal of Environmental Sciences, 14(1):33-42.
Asadi, H., Sattari, M., Motalebi, Y., Zamani-Faradonbeh, M. and Gheytasi, A. 2017. Length-weight relationship and condition factor of seven fish species from Shahrbijar River, southern Caspian Sea basin, Iran. Iranian Journal of Fisheries Sciences, 16(2):733-741.
Asadi, H., Sattari, M. and Radkhah, A. R. 2016. Distribution pattern of *Alburnoides eicwaldii* (*sic*) in the Tootkabon River (Caspian Sea basin, Iran). Journal of Entomology and Zoology Studies, 4(4):92-96.
Asadi, T. and Gharzi, A. 2016. Histological and histochemical study of digestive tract in zarde fish, *Capoeta damascina*, in Sezar River, Lorestan Province. Journal of Animal Research (Iranian Journal of Biology), 28(4):389-398. In Farsi.
Asadi, T., Zanguee, N., Mousavi, S. M. and Yavari, V. 2016. Effects of ginger extract on some hematological and serological parameters and growth performance in *Barbus sharpeyi*. Journal of Marine Sciences and Technology, 15(1):100-110. In Farsi.
Asadi Vaighan, A., Talebbeydokhti, N., Massah Bavani, A. and Whitehead, P. 2019. Modeling impacts of climate and land use change on streamflow, nitrate, and ammonium in the Kor River, southwest of Iran. Journal of Water and Climate Change, 10(4):818-834.
Asadian, M., Shahsavani, D. and Kazerani, H. R. 2015. Growth promoting effects of a multi-strain probiotic on common carp (*Cyprinus carpio*) fingerlings. Iranian Journal of Veterinary Science and Technology, 7(2):63-74.
Asadian, N., Chamani, A. and Abolhassani, M. H. 2020. The trophic status of the Zayandeh River dam lake in the spring and summer, 2017. International Journal of Aquatic Biology, 8(3):209-215.
Asadolahi, Z., Danehkar, A. and Asadolahi, Z. 2012. Protective zoning of Choghakhor Wetland by spatial multi criteria evaluation (SMCE). Journal of Wetland Ecobiology, 4(13):35-47.

In Farsi.
Asadollah, S. and Mahboobi Soofiani, N. 2008. Some aspects of the growth and reproduction of (*Capoeta damascina* Valenciennes 1842) from the Hanna wetland, Semirum. The First National Conference on Fisheries Science and Aquatic Organisms, Lahijan, Iran, 6-8 May 2008 (title).
Asadollah, S., Soofiani, M. N., Keivany, Y. and Hatami, R. 2017. Age and growth of the Mesopotamian barb, *Capoeta damascina*, in central Iran. Iranian Journal of Fisheries Sciences, 16(2):511-521.
Asadollah, S., Soofiani, N. M., Keivany, Y. and Shadkhast, M. 2011. Reproduction of *Capoeta damascina* (Valenciennes, 1842), a cyprinid fish, in Zayandeh-Roud River, Iran. Journal of Applied Ichthyology, 27(4):1061-1066.
Asadollah Nasrabadi, S., Kochanian, P., Mahboobi Soofiani, N., Yavari, V. and Jallali, A. H. 2018. The effect of different carbon sources on bacterial count and histometric of *Cyprinus carpio* intestine, reared in a biofloc system. Journal of Animal Environment, 10(4):351-360. In Farsi.
Asadzadeh Mangili, A., Mokhayer, B. and Jalali, B. 2000. Health assessment of external parasites of cultured Cyprinidae in pen culture of Anzali Lagoon. Pajouhesh va Sazandegi, 13(3)(47):96-101. In Farsi.
Asareh, R., Mohammad Nejad Shamoushaki, M. and Faghani Langroodi, H. 2013. Effect of starvation on some blood serum factors in *Cyprinus carpio* (Linnaeus, 1758). Journal of Animal Physiology and Development (Journal of Biological Sciences), 6(1):1-9. In Farsi.
Asefi, M. and Zamani-Ahmadmahmoodi, R. 2015. Mercury concentrations and health risk assessment for two fish species, *Barbus grypus* and *Barbus luteus*, from the Maroon River, Khuzestan Province, Iran. Environmental Monitoring and Assessment, 187(10):653.
Asgardun, S. and Nowferesti, H. 2014. Length-weight relationship of *Pseudoras* (*sic*) *parva* from the Mashhad Chalidare Dam, Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Asgardun, S., Nowferesti, H., Ghojoghi, A. and Patimar, R. 2015. The relationship between length-weight of *Capoeta aculeata* from Gamasiab River, Kermanshah and *Capoeta trutta* from Kangir River, Siahgel, Iran. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 45.
Asgardun, S., Nowferesti, H., Golzarianpour, K. and Vatandoust, S. 2014. Morphological diversity among *Capoeta trutta* populations along in three western rivers of Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Asgari, R., Mojazi Amiri, B., Eagderi, S. and Nematollahi, M. A. 2013. A survey on osmoregulatory potential of bream, *Abramis brama* (Berg, 1949 (*sic*)) fry for restocking management programs. Scientific Journal of Animal Science, 2(3):66-73.
Asghari, A., Abidinia, M. A. and Tolooei Azar, A. 2019. Genealogy and analyses of “The Little Black Fish Symbols”. Literary Text Research (Persian Language and Literature), 23(80):175-204. In Farsi.
Asghari, M., Alizadehdoghikolaei, E., Safari, R., Arshadi, A. and Saeidiasl, M. R. 2010. Effect of bacteriocine Z and sodium acetate on shelf-life of silver carp (*Hypophthalmichthys molitrix*) fillet during refrigerator storage. Innovation in Food Science and Technology (Journal of Food Science and Technology), 1(3):55-64. In Farsi.

Asgharnia, M., Abbasi, K. and Ghasemi, M. 2017. Survey on surface parasitic abundance in *Rutilus frisii kutum* fingerlings releasing to Sefidrood river in Guilan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Asgharnia, M., Abbasi, K., Khodaparast, S. H. and Ghasemi, M. 2018. Investigation on occurrence and intensity of parasitic infections on freshwater fish of Kardeh Lake in Khorasan Province. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Asgharnia, M. and Ghasemi, M. 2018. A study on parasitic monogeneans abundant on gills of common carp, *Cyprinus carpio*, in Guilan province warm water fish farms. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Asgharnia, M. and Ghasemi, M. 2021. External parasite infection in common carp (*Cyprinus carpio*) and bighead (*Hypophthalmichthys nobilis*) from fish farms in Guilan province. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Asgharnia, M., Ghasemi, M. and Abbasi, K. 2017a. Survey on occurrence of ectoparasites of *Carassius carassius* in some warm water fish farms of Guilan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Asgharnia, M., Ghasemi, M. and Abbasi, K. 2017b. Case report on infection to *Ligula intestinalis* Cestoda in fish *Carassius carassius* in from (*sic*) Iran water resources. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Asgharnia, M., Yeganaeh, S., Jafarpour, S. A. and Safari, R. 2017. Use of chemical method for preparing of protein hydrolysate from silver carp (*Hypophthalmichthys molitrix*) viscera and its application as culture media for *Listeria monocytogenes*. Iranian Scientific Fisheries Journal, 26(3):11-22. In Farsi.

Asgharzadeh, S. and Taati, R. 2020. Evaluation of growth performance, some hematological and immune parameters of common carp (*Cyprinus carpio*) fingerlings fed acidifier supplementation. Journal of Animal Environment, 12(1):269-276. In Farsi.

Ashja Ardalan, A., Rad, E. and Rajabi, A. 2011. Investigation on some biological characteristics in *Leuciscus cephalus* at Babolrud River, Mazandaran Province. Journal of Marine Science and Technology Research, 5(4):19-32. In Farsi.

Ashja Ardalan, A., Rad, E. and Salehi, M. 2010. Investigation on reproductive biology in *Leuciscus cephalus* at Babolrud River (Mazandaran Province). Technology Research, 4(4):23-36.

Ashoori, A. 2010. Breeding biology and success of the little egret *Egretta garzetta* in Karfestan Ab-bandan, Roudsar, Gilan Province, northern Iran. Podoces, 5(1):29-34.

Ashoori, A., Moradi, H. V., Rezaiee, H. R. and Mahiny, A. S. 2017a. Nest position, breeding success and diet of the Black-crowned Night Heron, *Nycticorax nycticorax* in the Anzali Wetland, northern Iran (Aves: Ardeidae). Zoology in the Middle East, 63(4):283-290.

Ashoori, A., Moradi, H. V., Rezaiee, H. R. and Mahiny, A. S. 2017b. Dietary segregation of four ardeid species in Anzali International Wetland, northern Iran. Waterbirds, 40(4):377-389.

Ashoori, A., Naderi, S. and Barati, A. 2012. Nestling diet of the grey heron, *Ardea cinerea*, in

Siahkeshim, northern Iran (Aves: Ardeidae). Zoology in the Middle East, 57(1):139-142.
Ashouri, M., Piry, Z. and Rezaei Moghaddam, M. H. 2015. A comparison of the influence of the Sattarkhan reservoir dam on the upstream and downstream of the Ahar Chai River, NW Iran. Environmental Earth Sciences, 73(8):4099-4108.
Ashtab, D., Gholamalifard, M. and Mahmoudi, N. 2018. Species suitability modelling of Caspian kutum (*Rutilus frisii kutum*) based on a multi-criteria evaluation for in southern Caspian Sea. Journal of Animal Environment, 9(4):235-246. In Farsi.
Ashtiani-Zarandi, M. A. 1990. The current status of waterfowl and wetland conservation in the Islamic Republic of Iran, pp. 81-83. In: Matthews, G. V. T. (Ed.). Managing Waterfowl Populations. Proceedings of the International Waterfowl and Wetlands Research Bureau (IWRB) Symposium, Astrakhan 1989, IWRB Special Publication, Slimbridge, 12.
Askari, G., Hedayati, S. A. A. and Kolangi Miandare, H. 2014. Comparison of morphometric and meristic characters of *Garra rufa* (Heckel, 1843) in spring and autumn in the Shapour River, Fars, Iran. Journal of Applied Ichthyological Research, 2(1):93-104. In Farsi.
Askari, Gh., Shabani, A. and Rezaei, H. R. 2014. Study of genetic diversity of *Garra rufa* (Heckel, 1843) in Fars Province using microsatellite markers. Modern Genetics Journal, 8(4)(35):341-348. In Farsi.
Askari, Gh., Shabani, A. and Rezaei, H. R. 2017. Genetic diversity of *Garra persica* (Berg, 1914) in the Kohgiluyeh and Boyer-Ahmad province by using microsatellite marker. Journal of Experimental Animal Biology, 5(4):39-48. In Farsi.
Askari Hesni, M. 2016. Changes of thyroid hormones in common carp (*Cyprinus carpio*) exposed to sub lethal concentrations of cadmium. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Askari Hesni, M., Mohammadi, F., Teimori, A, and Madjdzadeh, S. M. 2020. The intraspecific variations of otolith and urohyal bone structures in *Capoeta fusca* (Nikolskii, 1897) (Teleostei: Cyprinidae) in Loot basin. Journal of Animal Research (Iranian Journal of Biology), 33(2):198-211. In Farsi.
Askari Hesni, M. and Naqshbandi, N. 2017. Effects of Glyphosate on gill structure of common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 84-89. In Farsi.
Askari Hesni, M., Tahami, M. S., Parsi, B., Zangiabadi, S. and Gholami, A. 2014. New report of *Capoeta damascina* (Teleostei: Cyprinidae) from aqueducts and springs in Kerman province, Iran. Journal of Biodiversity and Environmental Sciences, 4(3):196-201.
Askari Sari, A. A. 2010. The study of heavy metals (Pb, Hg and Cd) in (*Barbus grypus*) and (*Liza abu*) in Karoon and Karkheh rivers. Journal of Marine Biology, 1(4):95-107. In Farsi.
Askary Sary, A., Hosseini Nezhad, S., Chelemal Dezfoul Nezhad, M. and Velayatzadeh, M. 2017. Study on the effects of different cooking methods on concentration of essential elements (Fe, Zn, Cu, Ni) in *Cyprinus carpio*. Journal of Food Hygiene, 7(3):61-76. In Farsi.
Askary Sary, A. and Karimi Sari, V. 2014a. Effects of ecological changes on the iron levels and hazard quotient (HQ) on muscle of pelagic, demersal and neritic fish from Khuzestan, south west of Iran. Journal of Biodiversity and Environmental Sciences, 5(5):23-28.
Askary Sary, A. and Karimi Sari, V. 2014b. The study on changes of nutrition on iron levels and hazard quotient (HQ) on plankton eater, carnivores, omnivores and herbivores fishes

from Khuzestan, South West of Iran. Journal of Biodiversity and Environmental Sciences, 5(5):166-171.

Askary Sary, A. and Karimi Sary, V. 2017. Measurement and comparative of iron levels and hazard quotient (HQ) on muscle of farmed and marine fishes from Khuzestan, south west of Iran. Iranian Scientific Fisheries Journal, 25(5):1-10. In Farsi.

Askary Sary, A., Khodadadi, M. and Mohammadi, M. 2011. Concentration of heavy metal (Cd, Pb, Ni, Hg) in muscle, gill and liver tissues of *Barbus xanthopterus* in Karoon River. Iranian Scientific Fisheries Journal, 19(4):97-106. In Farsi.

Askary Sary, A. and Mohammadi, M. 2011a. Human health risk assessment of heavy metals in fish from freshwater. Research Journal of Fisheries and Hydrobiology, 6(4):404-411.

Askary Sary, A. and Mohammadi, M. 2011b. *Barbus grypus* as a bioindicator of heavy metal pollution in downstream Karoon and Dez rivers in Khouzestan, Iran. Advances in Environmental Biology, 5(10):3056-3063.

Askary Sary, A. and Mohammadi, M. 2012a. Mercury concentrations in commercial fish from freshwater and saltwater. Bulletin of Environmental Contamination and Toxicology, 88(2):162-165.

Askary Sary, A. and Mohammadi, M. 2012b. Lead bioaccumulation and toxicity in tissues of economically (*sic*) fish species from river and marine water. Bulletin of Environmental Contamination and Toxicology, 89(1):82-85.

Askary Sary, A. and Mohammadi, M. 2015. The arsenic survey and comparison accumulation in muscle and liver of economic species (*Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Aristichthys nobilis*, *Oncorhynchus mykiss*) farmed fishes from Iran. Journal of Wetland Ecobiology, 7(1):69-76. In Farsi.

Askary Sary, A., Salehpour, A. and Khodadadi, M. 2013a. Comparison and measured levels of heavy metals such as Pb, Cd in muscle of a barb (Cyprinidae: *Carasobarbus luteus*) in Shapoor River in Fars province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 67 (abstract).

Askary Sary, A., Salehpour, A. and Khodadadi, M. 2013b. Comparison levels of heavy metals such as Pb, Cd in liver of the Mesopotamian barb (Cyprinidae: *Capoeta damascina*) in Shapoor River in Fars province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 68 (abstract).

Askary Sary, A. and Velayatzadeh, M. 2013. Bioaccumulation lead and zinc metals in the liver and muscle of *Cyprinus carpio*, *Rutilus frsii kuttom* (*sic*) and *Liza auratus*. Journal of Food Hygiene, 3(1)(9):89-99. In Farsi.

Askary Sary, A. and Velayatzadeh, M. 2014a. Arsenic concentrations in commercial fish from freshwater and saltwater. Journal of Biodiversity and Environmental Sciences, 4(6):1-7.

Askary Sary, A. and Velayatzadeh, M. 2014b. Lead and zinc levels in silver carp (*Hypophthalmichthys molitrix* Valenciennes, 1844), grass carp (*Ctenopharyngodon idella*, Cuvier and Valenciennes, 1844) and bighead carp (*Aristichthys nobilis*, Richardson, 1845) from Iran. International Journal of Biosciences, 4(12):306-313.

Askary Sary, A. A. and Mohammadi, M. 2012b. Mercury concentrations in commercial fish from freshwater and saltwater. Bulletin of Environmental Contamination and Toxicology, 88(2):162-165.

Askerov, F. S., Zaytsev, Y. Y., Kasumov, R. Y. and Kuliyev, Z. 2001. Bioraznoobrazie: Chudesnye Ryby Kaspiya/Biodiversity: Amazing Caspian Fishes. Print Studio, Baku. 164 pp. In Russian and English.

Aslaanparviz, H. 1994. Artificial spawning of Caspian white fish, Rutilus frissii (*sic*) kutum. Abzeeyan, Tehran, 4(12):28-29. In Farsi.

Assadollahpoor, F., Rafiee, H., Pishbahar, E. and Mohammadrezaei, R. 2018. Estimating the demand for fish on the basis of lexicographic preferences: a case study of Mazandaran Province. Iranian Journal of Agricultural Economics and Development Research, 49(2):191-202. In Farsi.

Assar, S., Rajabzadeghatrami, E. and Mohammadi Roozbahani, M. 2014. Investigation of water quality of Dez Dam from interior, reservoir and exterior up to regulatory dam using indexs (*sic*) of NSFWQI and BCWQI. Journal of Wetland Ecobiology, 6(20):79-91. In Farsi.

Assareh, R., Mohammad Nejad Shamoushaki, M., Faghani Langroodi, H. and Karbakhsh Ravari, A. 2012. Effect of starvation period on growth performances and survival of *Cyprinus carpio* (Linnaeus, 1758). Journal of Research in Biology, 2(5):418-423.

Assareh, R., Mohammad Nejad Shamoushaki, M., Faghani Langroodi, H. and Mazini, M. 2013. Effect of starvation on carcass quality of *Cyprinus carpio* (Linnaeus, 1758). World Journal of Zoology, 8(2):170-174.

Astani, E., Vahedpour, M. and Babaei, H. 2016. Organic and total mercury concentration in fish muscle and thermodynamic study of organic mercury extraction in fish protein. Ecopersia, 4(3):1517-1526.

Atabati, A., Keykhosravi, A., Askari-Hesni, M., Vatandoost, J. and Motamedi, M. 2015. Effects of copper sulfate on gill histopathology of grass carp (*Ctenopharyngodon idella*). Iranian Journal of Ichthyology, 2(1):35-42.

Atabati, A., Shabanipour, N., Mashayekhi, F. and Aghamaali, M. R. 2010. Study of pituitary gland development in Rutilus frisii kutum before hatching until adult stage. Veterinary Journal (Pajouhesh va Sazandegi), 22(4)(85):34-43. In Farsi.

Ataie, M. J., Hosseini Shekarabi, S. P. and Jalili, S. H. 2019. Gelatin from bones of bighead carp as a fat replacer on physicochemical and sensory properties of low-fat mayonnaise. Journal of Microbiology, Biotechnology and Food Sciences, 8(4):979-983.

Ataimehr, B., Mojazi Amiri, B., Mirvaghefi, A., Nezami, Sh. and Riazi, G. H. 2010. Effect of different salinity on ions, osmolarity, water concentration of body tissue, gill chloride cells and mortality percentage of juveniles of Caspian roach (*Rutilus frisii kutum* Kamensky 1901). Iranian Scientific Fisheries Journal, 19(2):115-130. In Farsi.

Atallah, M. A. 1978. Study of morphological and biological characteristics of gattan *Barbus xanthopterus* from Tigris River and Al-Tharthar water reservoir. St. Fis. Company, Iraq. In Arabic.

Avakh-Kismi, M. 1996. The first Iranian fish propagation plant replaced by a sand/silt producer plant. Abzeeyan, Tehran, 7(10):36-38. In Farsi.

Avlijaš, S., Ricciardi, A. and Mandrak, N. E. 2018. Eurasian tench (*Tinca tinca*): the next Great Lakes invader. Canadian Journal of Fisheries and Aquatic Sciences, 75(2):169-179.

Ayati, B. 2003. Investigation of sanitary and industrial wastewater effects on Anzali Reserved Wetland (Final Report). Report presented to MAB-UNESCO by Environmental Engineering Division, Civil Engineering Department, Tarbiat Modarres University, Tehran. 52 pp.

Ayati, B. 2016. Investigation of sanitary & industrial wastewater effects on Anzali Reserved Wetland, pp. 55-61. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Ayazi, M. 1961. Drainage and reclamation problems in the Garmsar area, pp. 285-290. In: Salinity Problems in the Arid Zones. Proceedings of the Teheran Symposium, UNESCO, Rome. 395 pp.
Aydin, R., Calta, M., Sen, D. and Coban, M. Z. 2004. Relationships between fish lengths and otolith length in the population of *Chondrostoma regium* (Heckel, 1843) inhabiting Keban Dam Lake. Pakistan Journal of Biological Sciences, 7(9):1550-1553.
Aydın, R., Yüksel, F., Ural, M., Küçükgül Güleç, A. and Şener Ural, M. 2012. Keban ve Karakaya Baraj Göllerinde Yaşayan *Capoeta trutta* (Heckel, 1843)'nin Büyüme parametrelerinin Karşilaştirilmasi [Comparison of growth parameters of *Capoeta trutta* (Heckel, 1843) living in Keban and Karakaya Dam Reservoirs]. Journal of Fisheries Sciences, 6(4):306-320.
Ayvazyan, A., Vasilyan, D. and Böhme, M. 2018. Morphology of the pharyngeal dentition of the genus *Capoeta* (Cyprinidae) based on x-ray computed tomography: Implications for taxonomy and phylogeny. Annual Meeting, American Society of Ichthyologists and Herpetologists, Rochester, New York, 11-15 July 2018 (abstract).
Ayvazyan, A., Vasilyan, D. and Böhme, M. 2019a. 3D morphology of pharyngeal dentition of the genus *Capoeta* (Cyprinidae): Implications for taxonomy and phylogeny. Journal of Zoological Systematics and Evolutionary Research, 57(1):179-190.
Ayvazyan, A., Vasilyan, D. and Böhme, M. 2019b. Possible species-flock scenario for the evolution of the cyprinid genus *Capoeta* (Cypriniformes: Cyprinidae) within late Neogene lake systems of the Armenian Highland. PLoS ONE, 14(5):e0215543.
Azadi, H. and Safari, R. 2017a. Effect of dietary administration of *Ferula assafoetida* powder on mucus protein pattern in common carp (*Cyprinus caprio*) (*sic*) The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 18-21. In Farsi.
Azadi, H. and Safari, R. 2017b. Effect of using sodium propionate in diet on protein mucus pattern in common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 22-25. In Farsi.
Azadian, M., Moosavi Nasab, M. and Yousefi, A. R. 2011. Production protein isolate and surimi from silver carp (*Hypophthalmichthys molitrix*) and survey their gel and powder colorimetric and chemical parameters. Iranian Scientific Fisheries Journal, 20(3):1-10. In Farsi.
Azadikhah, D., Rasouli, S., Nekuie Fard, A., Rahimpour, S., Behboodi, N. and Khodadadi, A. 2012. Survey of diplostomiasis disease in fishes of Mahabad Dam in west Azarbayjan. Journal of Aquatic Animals and Fisheries, 3(10):1-7. In Farsi.
Azadikhah, D., Roosan-Miandoab, O., Rasouli, S., Nekuie-Fard, A. and Fakhri, H. 2013. Infection of *Abramis brama* with *Ligula intestinalis* in Aras reservoir (West Azerbaijan - Iran). Annals of Biological Research, 4(7):171-173.
Azar, S., Dezfooli Nezhad, M. C. M. and Javaheri, M. 2017. Stevia (*Stevia rebaudiana*) extract effect on resistance against stress induced condensation of common carp (*Cyprinus carpio*). Journal of Animal Environment, 9(1):263-274. In Farsi.
Azari, K., Allahbeygi Chamjangalli, J., Ghasemi, A., Hoseinifar, H., Shabani, A. and Paknezhad, H. 2019. The effects of sub-lethal concentrations of multi walled carbon nanotube on serum biochemical parameters in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 8(2):53-59. In Farsi.
Azari Takami, G. 1979. Fecundity of *Rutilus frisii kutum* (Kamensky). Journal of the Veterinary

Faculty of the University of Tehran, 35(1-2):66-78. In Farsi.
Azari Takami, G. 1984. The principles of fish propagation and farming. Shilat, Tehran. 152 pp. In Farsi.
Azari Takami, G. and Maghsoodifar, A. E. 2016. The study on the effects of synergism on organic production of warm water fishes. Journal of Aquaculture Sciences, 3(1):74-81. In Farsi.
Azari Takami, G. and Rajabi Nezhad, R. 2003. Study of fecundity of shemaya (shah-koolee) [*Chalcalburnus chalcoides* (Guldenstadt, 1772)] in the Sefid Rud River. Journal of Science and Technology of Agriculture and Natural Resources, 6(4):231-239. In Farsi.
Azari Takami, G., Razavi, B. and Hosseinpoor, N. 1990. A study on artificial propagation and culturing of the white fish *Rutilus frisii kutum* (Kamensky) in Iran. Journal of the Veterinary Faculty of the University of Tehran, 45(1):69-90. In English.
Azari Takami, G., Shahidi, H. and Adeli, A. 2000. Estimation of female silver carp broodstocks "Hypophthalmichthys molitrix" for selection breeding. Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(2):45-50. In Farsi.
Azarin, H., Imanpoor, M. R., Rajabpour, M., Mehdinejad, N. and Nodeh, A. J. 2015. The effect of different levels of $Fe(SO_4)_2(7H_2O)$ and probiotic (BioPlus-2B) on some blood parameters of *Rutilus frisii kutum*. Nova Biologica Reperta, 2(2):82-90. In Farsi.
Azarvandi, A.R., Dalimi Asi, A., Ghamari, Z. and Ghebleh, F. 1999. A study on intestinal helminths of pond cultured fish in west Azerbaijan province. Pajouhesh va Sazandegi Journal, 43:42-43. In Farsi.
Azh, Z., Sourinejad, I. and Keivany, Y. 2012. A study on meristic and morphometric characteristics of the new riffle bleak species *Alburnoides petrubanarescui*, from Urmia Lake basin. Journal of Aquatic Ecology, Hormozgan University, 1(3):49-59. In Farsi.
Azhdari, A. 2007. A study of fish ice cream formulation by use of silver carp proteins instead of milk proteins. Ph.D. Thesis, Islamic Azad University, Science and Research Branch, Tehran. 93 pp. In Farsi.
Azimi, A., Jafaryan, H., Harsij, M., Gholipour, H. and Patimar, R. 2016. Effect of C/N different ratios on water quality parameters and growth performance of common carp (*Cyprinus carpio*) fingerlings in biofloc system. Journal of Aquaculture Development, 10(4):75-89. In Farsi.
Azimi, Z., Rufchaie, R. and Pourgholami Moghadam, A. 2014. Determining the lethal concentration LC50 96 h sodium nitrite and its impact on the liver tissue of white fish (*Rutilus kutum* Kamensky, 1901). Journal of Applied Ichthyological Research, 2(3):59-72. In Farsi.
Azimi Rudkenari, S. and Mohammadi Galangash, M. 2021. Residues of organic chlorine compounds on the southern coasts of the Caspian Sea. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Azizi, F., Anvarifar, H. and Mousavi-Sabet, H. 2015. Morphological differentiation between isolated populations of Caspian spirlin (*Alburnoides eichwaldii*) (Pisces: Cyprinidae) affected by dam. International Journal of Animal Biology, 1(2):28-37.
Azizi, F., Khoshkholgh, M., Rahmani, H., Sattari, M. and Anvarifar, H. 2015. Population dynamics of spirlin (*Alburnoides* sp.) (Pisces: Cyprinidae) at the up and down stream of Shahid Rajaii dam of Tajan River. Journal of Animal Environment, 6(4):121-134. In Farsi.

Azizi, F., Khoshkholgh, M., Rahmani, H., Sattari, M. and Anvarifar, H. 2018. Investigation of dam effect of Shahid-Rajaie on variation and differentiation of spirlin (*Alburnoides* sp.) (Pisces: Cyprinidae) in the Tajan River (Iran). Journal of Animal Environment, 7(1):29-39. In Farsi.

Azizi, H., Shafiei, S. and Sadeghi, E. 2008. Study of parasitic infection in digestion system of common carp, *Cyprinus carpio*, in the Zayandehrood Lake Dam. www.civilica.com.

Azizi, H. R., Tahmasebi, A., Adel, M., Parseh, A. and Shafiei, Sh. 2013. Investigation on relative frequency of some protozoan ectoparasites infestation in *Hemiculter leucisculus* and *Abramis brama orientalis* fishes of Anzali Lagoon. Iranian Veterinary Journal, 9(1)(38):95-102. In Farsi.

Azizi, H. R., Tahmasebi Kohiani, A., Nematolahi, A., Adel, M., Borijan, A. and Jafari Ranani, M. 2013. An investigation on relative frequency of monogeneans infestation in Anzali Lagoon fishes (*Hemiculter leucisculus* and *Abramis brama orientalis*) as an indicator for contamination of Pyrbazar River. Veterinary Journal (Pajouhesh va Sazandegi), 25(4)(97):6-12. In Farsi.

Azizi, S., Patimar, R., Bahalkeh, A. and Atania, M. 2017. Some growth parameters and condition factor of *Garra rufa* in Sirwan River Kordestan Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Azizi, S., Patimar, R., Bahalkeh, A. and Kor, A. 2017. Richness and diversity of fish assemblages in Sirwan River, Kurdistan Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Azizi Jalilian, M., Shayesteh, K., Danehkar, A. and Salmanmahiny, A. 2020. A new ecosystem-based land classification of Iran for conservation goals. Environmental Monitoring and Assessment, 192:182.

B

Babaeeinezhad, L., Bahr Kazemi, M., Saeedi, A. A. and Khan Zamani, M. M. 2013. Effects of two chemical anesthetic drugs as lidocaine, sodium bicarbonate and herbal anesthetics clove extract on blood parameters and levels of cortisol in males of Caspian kutum (*Rutilus frissi* (*sic*) *kutum*). Breeding and Aquaculture Sciences Quarterly, 1(2):11-22. In Farsi.

Babaei, H. 2017. Study of Golabar dam reservoir in Zanjan province (Zanjan Province). Iranian Fisheries Science Research Institute, Tehran. 74 pp. In Farsi.

Babaei, H., Khodaparast, S. H., Dadayghandi, A. and Sabiri, H. 2017. Measuring the concentrations of essential and unnecessary elements (Cu, Zn, Pb) in Sefidroud River protection of aquatic specs (Provence Guillan) (*sic*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Babaei, H., Khodaparast, S. H. and Mirzajani, A. R. 2016. Determination of fisheries potential development of Golabar Lake by investigation on same (*sic*) physical and chemical parameter. Journal of Aquaculture Development, 10(3):27-27. In Farsi.

Babaei, H., Khodaparast, S. H., Valipour, A. R. and Saberi, H. 2016. Survey and determination of heavy metals and some pesticides levels at Yamchi Dam outlet Ardabil province for aquaculture development. New Technologies in Aquaculture Development (Journal of Fisheries), 9(4):39-50. In Farsi.

Babaei, H. and Khodaprast, S. 2016. Determination of heavy metals in different species of fish in

Amirkolaye Wetland (Gilan, Province). The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Babaei, H., Khodaprast, S. H. and Zolfinjad, K. 2017. Heavy metals (Cu, Cd, Cr, Zn, Pb) determination in muscle tissues of fish (*Abramis brama*) Amirkolaye Wetland (Provence Guilin) (*sic*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Babaei, O., Hashemzadeh Segherloo, I., Pourahmad, R., Pouria, M. and Abdoli, A. 2017. Analysis of the systematic status of *Capoeta aculeata* in qanats of Naieen-Ardestan, Namak and Karun basins (Iran) using the gene COI. Journal of Fisheries (Iranian Journal of Natural Resources), 70(1):26-35. In Farsi.
Babaei, O., Hashemzadeh Segherloo, I., Purahmad, R. and Pouria, M. 2014. The analysis of the systematic status of *Capoeta aculeata*, using *COI* gene. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Babaev, A. G., Ammaniyazov, K. N. and Muradov, Ch. 1997. Kolevanie uroviya kaspiiskogo morya i ego ekologicheskie posledstviya [Fluctuation in the Caspian Sea level and its ecological consequences]. Problemy Osvoeniya Pustyn’, 6(1996):3-11
Babaii, A. 1995. Examining the fish consumption market development in Iran (Tehran). M.Sc. Thesis, University of Tehran. 232 pp. In Farsi.
Babaii, M. 2002. Effective parameters on farmed fish consumption. M.Sc. Thesis, University of Tehran. 231 pp. In Farsi.
Babaiinezhad, L. and Bahrekazemi, M. 2019. Effects of three anesthetics of clove extract, sodium bicarbonate, and lidocaine on blood parameters and cortisol level on male and female broodstocks of Caspian kutum (*Rutilus kutum*). International Journal of Aquatic Biology, 7(5):260-270.
Babakhani, A. 2021. Feasibility study of using Caspian kutum waste in the production of edible quality fish oil. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 5 pp. In Farsi.
Babakhani, A., Rezaei, M., Hosseini, H. and Bahramifar, N. 2010. Effect of cooking methods on the proximate composition and fatty acids profile in muscle of kutum roach (*Rutilus frisii kutum*). Journal of Marine Sciences and Technology, 9(1):37-48. In Farsi.
Babazadeh, M., Kousha, A. and Safari, R. 2008. Changes in nutritional factors of freezed kutum (*Rutilus frisii kutum*). World Journal of Zoology, 3(2):51-53.
Babazadeh, M., Moeini, S., Rezaei, M. and Safari, R. 2008. Evaluation of some chemical and organoleptic changes of kutum (*Rutilus frisii kutum*) stored at -18°C. Journal of Marine Sciences and Technology, 7(1-2):31-37. In Farsi.
Babazadeh, M. and Shapoori, M. 2017. A survey on morphometric and meristic characters of *Squalius cephalus*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 95-100. In Farsi.
Babazadeh, M. and Vatandoost, S. 2013. A survey on morphometric and meristic characteristics of *Squalius cephalus* (Linnaeus, 1758) population of Tajan River in Mazandaran Province. Journal of Marine Science and Technology Research, 8:96-110. In Farsi.
Backiel, T. and Zawisza, J. 1968. Synopsis of biological data on the bream *Abramis brama* (Linnaeus, 1758). Food and Agriculture Organization, Rome, Fisheries Synopsis, 36:iv + 110 pp.

Badfar, N. and Jafarpor, S. A. 2019. The integrated effects of hydrogen peroxide (H_2O_2), washing cycles and water to mince ratios on the color and surimi quality of silver carp (*Hypophthalmichthys molitrix*) mince. Iranian Scientific Fisheries Journal, 28(1):1-14. In Farsi.

Badfar, N. and Jafarpour, A. 2018. Textural quality and microstructure of surim gel from silver carp (*Hypophthalmichthys molitrix*) affected by application of hydrogen peroxide (H_2O_2) during mince washing process. Journal of Fisheries (Iranian Journal of Natural Resources), 70(3):274-283. In Farsi.

Badiei, N. H. 2002. Identification and study of qanat ichthyofauna of Bedjestan basin. M.Sc. Thesis, Ferdowsi University, Mashhad. 167 pp. In Farsi.

Badola, S. P. and Singh, H. R. 1984. Spawning of some important coldwater fish of the Garhwal Himalaya. Journal of the Bombay Natural History Society, 81(1):54-58.

Badri, M., Abdoli, A., Hasanzadeh Kiabi, B. and Karami, M. 2019. The study of temperature fluctuations effect on growth and age of *Schizothorax pelzami* (Kessler, 1870) in two river and lake habitats in north eastern Iran. Journal of Animal Environment, 11(2):267-276. In Farsi.

Badri, M., Abdoli, A., Kiabi, B. H. and Karami, M. 2015. Effect of fluctuation temperature on weight-length and condition factors of *Schizothorax pelzami* (Kessler, 1870) in two habitat lake and river. Journal of Fisheries, 67(4):479-489, 2. In Farsi.

Badri Fariman, M., Oryan, S., Ramin, M., Asghar, A. and Johary, S. A. 2010. Some biological characteristics study of *Capoeta fusca* in qanat ecosystem (case study South Khorasan). Journal of Wetland Ecobiology, 1(4):65-77. In Farsi.

Baes, M., Rahmati-Holasoo, H., Mirzargar, S. S., Ebrahimzadeh Mousavi, H. A., Soltani, M. and Taheri Mirghaed, A. 2017. Study of infestation with external and internal parasites in *koi Cyprinus carpio* L. in ornamental fish centers of Tehran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Baesi, F., Aberomandu, A., Ziaee Nejad, S. and Javaheri Baboli, M. 2016. Effects of commercial probiotic *Lactobacillus* on survival and growth parameters and nutritional indices of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 10(4):39-49. In Farsi.

Baesi, F., Aberomand, A., Ziaienezhad, S. and Javaheri Baboli, M. 2017. Optimizing the chemical composition of fish fillets and blood biochemical parameters of common carp (*Cyprinus carpio*) using various levels of commercial probiotic Lactobacillus (*Lactobacillus acidophilus*) in the diet. Iranian Scientific Fisheries Journal, 26(2):101-110. In Farsi.

Baghaei, S., Rajabzadeh Ghatrami, E., Mohammadiazarm, H. and Mousavi Seied, M. 2020. Effect of different levels of dietary choline and lipid on growth parameters and biochemical composition of common carp fillet (*Cyprinus carpio*). Journal of Wetland Ecobiology, 11(4):53-64. In Farsi.

Baghaei Jezeh, S., Javaheri Baboli, M. and Askary Sary, A. 2014. Influence of supplemental barley and formulated dry feed feeding on the growth, survival and fillet chemical composition of farmed common carp (*Cyprinus carpio* L.). International Journal of Biosciences, 5(7):137-143.

Bagheri, A., Kamrani, E. and Esmaeili, H. R. 2010. Identified fishes of Kol River in Hormuzgan Province. Iranian Scientific Fisheries Journal, 19(2):143-148. In Farsi.

Bagheri, F. 2007. Study of pesticide residues (diazinon, azinphosmethyl) in the rivers of

Golestan Province (Gorganrud and Gharesou). M.Sc. Thesis, Tehran University of Medical Sciences.

Bagheri, M., Bahrekazemi, M. and Javadian, R. 2020. Comparison of one- and two-stage injections of sGnRH + domperidone (ovaprim) with pituitary gland extract on spawning and reproduction quality indices of cultured and wild females of common carp (*Cyprinus carpio*). Journal of Aquaculture Sciences, 8(2):1-14. In Farsi.

Bagheri, M., Falahatkar, B. and Efatpanah, I. 2015. Effect of stocking density on growth indices, feed efficiency and water quality in hybrid asp (*Aspius aspius* ♀) x kutum (*Rutilus frisii* ♂). Journal of Aquaculture Development, 9(2):23-32. In Farsi.

Bagheri, M., Goudarzi, F., Zalaghi, A. H. and Savabieasfahani, M. 2016. Habitat characteristics and population size of *Iranocypris typhlops*, the Iran cave barb. Environmental Biology of Fishes, 99(2):179-185.

Bagheri, M., Mansouri, P., Talebi, M. A., Karami, M. and Farzan, M. 2018. Comparison of water quality parameters of the Parvaz and Sabzkoh rivers (Chaharmahal and Bakhtiari province) with aquaculture standards. Journal of Aquaculture Development, 12(3):1-14. In Farsi.

Bagheri, S. 1999. An ecological investigation on macrobenthic assemblage of Choghakhour Lagoon, Iran. Iranian Scientific Fisheries Journal, 8(3):37-52, 4. In Farsi.

Bagheri, S. 2005. Distribution and abundance of *Mnemiopsis leidyi* in the southern coasts of Caspian Sea (Guilan Province). Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bandar Anzali. http://en.ifro.ir (abstract).

Bagheri, S. 2006. An investigation on abundance and distribution of *Mnemiopsis leidyi* in Guilan waters, southwest Caspian Sea. Iranian Scientific Fisheries Journal, 14(4):1-16. In Farsi.

Bagheri, S., Abbasi, K., Moradi, M., Mirzajani, A. and Ramin, M. 2016. Study on species diversity and abundance of fishes in the Persian Gulf Martyrs Lake, Chitgar-Tehran. Iranian Scientific Fisheries Journal, 25(3):15-24. In Farsi.

Bagheri, S., Abbasi, K., Moradi, M., Sabkara, J., Mirzajani, A., Makaremi, M., Madadi, F. and Khatib, S. 2017. Identification, study on aquatic structure of Kan River, Tehran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Bagheri, S., Ghorbani, R. and Fazli, H. 2016. Investigation of correlation of some environmental factors on survival of *Rutilus frisii kutum* fingerlings (Case study: Iranian coastal water of the Caspian Sea). Journal of Animal Environment, 8(2):139-150. In Farsi.

Bagheri, S., Ghorbani, R., Fazli, H., Mahini, A. R. S. and Hosseini, S. A. 2015. Application of multi-criteria decision model in a qualitative ranking of the river at the time of release *Rutilus frisii kutum* (case study: Iranian coastal water of the Caspian Sea). Journal of Animal Environment, 7(2):131-140. In Farsi.

Bagheri, S., Kideys, A. and Mirzajani, A. 2005. Effect of *Mnemiopsis leidyi* invasion on zooplankton in the Iranian coasts of the Caspian Sea. Borok II, International Workshop, Invasions of Alien Species in Holarctic, 27 September-1 October 2005, Borok (abstract).

Bagheri, S., Mirzajani, A. and Sabkara, J. 2016. Preliminary studies on the impact of fish cage culture rainbow trout (*Oncorhynchus mykiss*) on zooplankton structure in the southwestern Caspian Sea. Iranian Journal of Fisheries Sciences, 15(3):1202-1213.

Bagheri, S., Mirzajani, A. R., Kiabi, B. and Roohi, A. Gh. 2010. Abundance and distribution of

the Caspian Sea ctenophore (*Mnemiopsis leidyi*). Iranian Journal of Biology, 23(3):460-469. In Farsi.

Bagheri, S., Niermann, U., Sabkara, J., Mirzajani, A. and Babaei, H. 2012. State of *Mnemiopsis leidyi* (Ctenophora: Lobata) and mesozooplankton in Iranian waters of Caspian Sea during 2008 in comparison with previous surveys. Iranian Journal of Fisheries Sciences, 11(4):732-754.

Bagheri, S., Sabkara, J., Yousefzad, E. and Zahmatkesh, Y. 2017. Ecological study of zooplankton communities in the Persian Gulf Martyrs Lake (Chitgar-Tehran) and the first report of the freshwater jellyfish *Craspedacusta* sp. (Cnidaria, Limnomedusae) in Iran. Iranian Scientific Fisheries Journal, 25(5):113-128. In Farsi.

Bagheri, T., Abdoli, A., Ada, A. and Hashemi, S. H. 2018. Study on some biological characteristics of *Barbus grypus* in Helle and Dalek rivers. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Bagheri, T., Abdoli, A. and Hedayati, S. A. A. 2010. Study of age and growth of crucian carp (*Carassius auratus*) in Gorganroud estuary. Iranian Journal of Biology, 23(6):843-849. In Farsi.

Bagheri, T., Gholizadeh, M., Abarghouei, S., Zakeri, M., Hedayati, A., Rabaniha, M., Aghaeimoghadam, A. and Hafezieh, M. 2020. Microplastics distribution, abundance and composition in sediment, fishes and benthic organisms of the Gorgan Bay, Caspian Sea. Chemosphere, 257:127201.

Bagheri, T. and Hedayati, A. 2016. Toxic effects of diadzin (*sic*) and genisten (*sic*) on steroid hormones and gonads in goldfish (*Carassius auratus*). FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Bagheri, T., Hedayati, A. A. and Abdoli, A. 2010. Study of some morphometric measurements, meristic traits, age and growth structure of *Barbus grypus* in Dalaki River. Iranian Journal of Biology, 23(3):389-396. In Farsi.

Bagheri Dorbadam, J. and Golzarianpour, K. 2013. A geometric morphometric study on new aqueduct populations of (Cyprinidae: *Cyprinion watsoni*) from east of Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 17 (abstract).

Bagheri Dorbadam, J., Patimar, R., Hajian, T. and Harsij, M. 2013. Reproductive parameters of Transcaspian Marinka (Cyprinidae: *Schizothorax pelzami*) in Sharak River, Khorasan Razavi province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 15 (abstract).

Bagheri Dorbadam, J., Patimar, R., Hajian, T., Safai, O. and Sheikh, M. 2013. Investigation of growth characteristics of *Cyprinion watsoni* from aqueducts of East Iran, Khorasan Province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 14 (abstract).

Bagherian, A. and Rahmani, H. 2007. Morphological differentiation between two populations of the shemaya, *Chalcalburnus chalcoides*: a geometrical morphometric approach. Zoology in the Middle East, 40:53-62.

Bagherian, A. and Rahmani, H. 2009. Morphological discrimination between two populations of shemaya, *Chalcalburnus chalcoides* (Actinopterygii, Cyprinidae) using a truss network. Animal Biodiversity and Conservation, 32(1):1-8.

Bagherian Nejad, S., Shayestehfar, A. and Ansari, S. 2019. Fonestical (*sic*) study of Cyprinidae family from Poldukhtar County, Iran. Journal of Animal Researches (Iranian Journal of Biology), 31(4):511-523. In Farsi.
Bagherzadeh Karimi, M. 2018. Anzali Mordab complex (Islamic Republic of Iran). In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.
Baghfalaki, M., Hosseini, S. A., Ghorbani, R., Dehghani, A. A. and Asghari, J. 2013. Monitoring malathion residues in water of the Gorganrood River estuary, Iran. World Journal of Fish and Marine Sciences, 5(6):660-663.
Baghfalaki, M., Hosseini, S. A., Imanpour, M. R., Soudagar, M. and Shalouei, F. 2010. Assigning on food regime of larvae and fingerling of wild carp (*Cyprinus carpio*) in earthen pond (Fish Culture and Propagation of Bony Fish Center of Sijaval). Iranian Journal of Biology, 22(4):574-580. In Farsi.
Baghfalaki, M., Hosseini, S. A., Imanpour, M. R., Soudagar, M., Shalouei, F. and Iri, M. 2009. Effect of *Cyprinus carpio* wild (sea) broodstock stocking density on survival and some growth parameters of larvae and fingerlings in earthen ponds. Journal of Agricultural Sciences and Natural Resources, 16(3):39-47. In Farsi.
Baghizadeh, E. and Khara, H. 2015. Variability in hematology and plasma indices of common carp (*Cyprinus carpio*, associated with age, sex and hormonal treatment. Iranian Journal of Fisheries Sciences, 14(1):99-111.
Baghizadeh, E., Sadeghpour, A., Khara, H. and Nezami, Sh. A. 2014. Effect of age on some blood cell and biochemical factors of common carp (*Cyprinus carpio* Linnaeus 1758). Journal of Aquatic Animals and Fisheries, 4(16):17-24. In Farsi.
Baghshani, H. and Shahsavani, D. 2013. Effects of lead acetate exposure on metabolic enzyme activities in selected tissues of common carp (*Cyprinus carpio*). Comparative Clinical Pathology, 22(5):903-907.
Baghvand, A., Nasrabadi, T., Bidhendi, G. N., Vosoogh, A., Karbassi, A. and Mehrdadi, N. 2010. Groundwater quality degradation of an aquifer in Iran central desert. Desalination, 260(1-3):264-275.
Bagirova, Sh. M., Askerova, Kh. M., Agayarova, A. E. and Agaeva, S. A. 2003. Dannye o biologicheskoi kharakteristike lenkoranskoi khramuli i kurinskogo usacha v p. Lenkoranchai [Data on the biological characteristics of the Lenkoran khramulya and the Kura barbel in the Lenkoranchai River]. Azerbaycan Milli Elmler Akademiyasinin Xeberleri, Biologiya Elmleri Seriyasi, 2003(3-4):128-132. In Azerbaijani.
Bagirova, Sh. M., Kuliev, Z. M. and Askerova, Kh. M. 1990. Morfobiologicheskaya kharakteristika karasya - *Carassius auratus gibelio* (Bloch) v vodoemakh Azerbaidzhana [Morphobiological characteristics of crucian carp - *Carassius auratus gibelio* (Bloch) in the reservoirs of Azerbaijan]. Izvestiya Akademii Nauk Azerbaidzhanskoi SSR, Seriya Biologicheskikh Nauk, 1990(1):57-64.
Bagley, F. R. C. 1976. A bright future after oil: dams and agro-industry in Khuzistan. The Middle East Journal, 30(1):25-35.
Bagnall, R. 1919. Large carp from Mesopotamia. Journal of the Bombay Natural History Society, 26(2):679-680.
Bahadori Birgani, S. and Chelehmal Dezfulnezhad, M. 2017. The effect of the extract supplements (*Myrtus communis* L.) on growth, survival, blood and immune system of fish common carp (*Cyprinus carpio*). Journal of Animal Researches (Iranian Journal of

Biology), 31(3):349-359. In Farsi.
Bahmani, M., Andreu Vieyra, C. V. and Habibi, H. R. 2007. Effects of cortisol on testicular apoptosis in goldfish (*Carassius auratus*). Iranian Journal of Fisheries Sciences, 6(2):1-14.
Bahmani, M., Hosseinfard, S. M. and Ehdaee, M. 2014. The effects of aqueous and alcoholic herb marjoram (*Origanum vulgare* L.) on survival and some blood parameters of common carp infected with *Aeromonas hydrophila*. Journal of Wetland Ecobiology, 6(3):73-81. In Farsi.
Bahmani, M., Pirasteh, S., Baradaran Noveyri, Sh., Kazemi, R. A. and Kouchinian, P. 2007. Water osmolarity effect on spermatocrit and its relations to spermatozoan count in male breeders of *Rutilus frisii kutum* in the south-western Caspian Sea. Iranian Scientific Fisheries Journal, 16(2):11-18. In Farsi.
Bahrami, Z., Alishahi, M. and Javadzadeh, N. 2018. Comparative acute toxicity of two herbicides, paraquat and 2,4-dichlorophenoxy acetic acid on *Barbus xanthopterus*. Journal of Wetland Ecobiology, 10(1):19-26. In Farsi.
Bahrami Babaheydari, S. 2013. Relationship between length and weigh of Gara (Cyprinidae: *Garra rufa*) in Marron (*sic*) River. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 18 (abstract).
Bahrami Babaheydari, S., Paykhan Heyrati, F., Akhlaghi, M. and Dorafshan, S. 2014. The dietary wood betony, *Stachys lavandulifolia* Vahl extract as a growth promoter and immune enhancer in common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Research, 15(4):359-363.
Bahrami Babaheydari, S., Paykan Heyrati, F., Dorafshan, S., Mahboobi Soofiani, N. and Vahabi, M. R. 2015. Effect of dietary wood betony, *Stachys lavandulifolia* extract on growth performance, haematological and biochemical parameters of common carp, *Cyprinus carpio*. Iranian Journal of Fisheries Sciences, 14(4):805-817.
Bahrami Kamangar, B., Ghaderi, E. and Hoseinpour, H. 2015. Growth and reproductive biology of *Capoeta damascina* (Valenciennes, 1842) from a tributary of Tigris. Iranian Journal of Fisheries Sciences, 14(4):956-969.
Bahrami Kamangar, B., Ghaderi, E. and Hossinpour, M. 2012a. The fish biodiversity of Gheshlagh River (Sanandj, Iran), a tributary of Tigris basin with occurrence of *Rutilus kutum* and *Hemiculter leucisculus*. The GIAN International Symposium on “Biodiversity in Zagros Region”, 5-6 May 2012, Tehran. 8 pp.
Bahrami Kamangar, B., Ghaderi, E. and Hossinpour, M. 2012b. Comparison of hematological indices and some plasma biochemical parameters in *Capoeta damascina* and *Capoeta trutta* from Gheshlagh Dam Lake, Sanandaj, Iran. Journal of Fisheries (Iranian Journal of Natural Resources), 65(2):135-151. In Farsi.
Bahrami Kamangar, B., Ghaderi, E. Maolodi, F. and Mohammadi, H. 2020. The first record of northern pike (*Esox lucius* Linnaeus) in the Zaribar Lake of Marivan, Kurdistan, Iran: A preliminary observation and assessment of morphology, diet, reproduction and invasive threat. Journal of Applied Ichthyological Research, 7(4):133-142. In Farsi.
Bahrami Sheikh Sarmast, E., Meshkini, S. and Safari, R. 2019. Effects of dietary administration of formic acid on mucosal immune, innate immune parameters of common carp fingerling (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 8(3):1-20. In Farsi.

Bahrani, A., Ghorbani, R., Fooladi, J. and Nojavan, S. 2020. Investigation of amino acids composition in common carp (*Cyprinus carpio* Linnaeus, 1758) using high-performance liquid chromatography (HPLC) and thin layer chromatography (TLC) from the southern Caspian Sea. Journal of Animal Environment, 12(3):207-214. In Farsi.

Bahrani, A., Qadermarzi, A., Moëzzi, F. and Jafar Nodeh, A. 2018. LC50-96h concentrations of paracin and pretilachlor in Caspian roach *Rutilus lacustris* (Pallas, 1814). Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Bahrekazemi, M. 2018. Anaesthetic effects of sodium bicarbonate, 2-phenoxy ethanol, clove extract and thyme extract on hematological indices and cortisol amount in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 7(3):19-27. In Farsi.

Bahrekazemi, M. and Asadi, M. 2018. Effect of dietary prebiotic mito (MHF-Y) and starvation on the compensatory growth, survival, and hematological parameters of common carp (*Cyprinus carpio* L. 1758). Iranian Journal of Aquatic Animal Health, 4(1):82-94.

Bahrekazemi, M., Memarian, K. and Nikbakhsh, J. 2020. Effect of continuous and intermittent oral administration of prebiotic mito on the growth factors, body composition, and hematological parameters in common carp *Cyprinus carpio*. Journal of Animal Environment, 11(4):229-236. In Farsi.

Bahremand, M., Kamrani, E., Rashidian, G. and Soleimanirad, A. 2016. Effects of dietary prebiotic immunogen on the compensatory growth and some hematological parameters in koi carp (*Cyprinus carpio* var. koi), after starvation period. Journal of Aquatic Ecology, Hormozgan University, 6(2):23-32. In Farsi.

Bahremand, M., Nematollahi, M. A. and Soleimanirad, A. 2017. Effects of dietary prebiotic immunogen on growth performance, hematological parameters and body composition of koi carp (*Cyprinus carpio* var. koi) fingerlings. Journal of Fisheries (Iranian Journal of Natural Resources), 70(2):117-125. In Farsi.

Bahremand, M. and Soleimanirad, A. 2017. Effects of stocking density on growth performance, immune and stress responses in koi carp (*Cyprinus carpio* va. koi) Linnaeus, 1758)). Journal of Aquatic Ecology, Hormozgan University, 6(4):10-20. In Farsi.

Bahri, A., Mokhayer, B., Khoshkkhoo, Z. and Asadzadeh Mangili, A. 2012. Investigating the parasitic infections in gold fish (*Carassius auratus*) native to Iran in aquariums in spring season in 2011 (non-imported) in Tehran Province. Journal of Aquatic Animals and Fisheries, 3(11):1-7. In Farsi.

Bahrpeyma, V., Setorki, M., Moshfegh, A. and Rahimbashar, M. R. 2017. Influence of environmental and internal factors on hematological parameters of *Alburnus chalcoides*. Journal of Animal Biology, 9(4):1-12. In Farsi.

Bai, Z., Liu, F., Li, J. and Yue, G. H. 2011. Identification of triploid individuals and clonal lines in *Carassius auratus* complex using microsatellites. International Journal of Biological Sciences, 7(3):279-285.

Bailey, R. M. 1951. The authorship of names proposed in Cuvier and Valenciennes' "Histoire Naturelle des Poissons". Copeia, 1951(3):249-251.

Baird, S. F. 1873. The fish of the Caspian Sea. Annual Record of Science and Industry, New York, 1873-1875:459.

Ba Kader, A. B. A., Al Sabbagh, A. L. T. El S., Al Glenid, M. Al S. and Izzidien, M. Y. S. 1983. Basic paper on the Islamic principles for the conservation of the natural environment.

International Union for Conservation of Nature and Natural Resources, Gland. 25 pp.
Bakhshalizadeh, S., Abbasi, K. and Rostamzade Liafuie, A. 2021. Length and weight of the Salmonidae and some Cyprinidae species in the southern Caspian Sea basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Bakhshi, F., Malekzadeh Viayeh, R. and Najdegerami, E. H. 2014. The application of biofloc technology in intensive culture of common carp (*Cyprinus carpio*) fingerlings. Journal of Animal Environment, 6(3):45-53. In Farsi.
Bakhshi, F., Najdegerami, E. H., Imani, A. and Sarvi Moghanloo, K. 2016. Effect of biofloc technology on growth performances, body composition and reduction of economic costs in intensive culture of common carp (*Cyprinus carpio*) juveniles. Journal of Veterinary Research, 71(2):163-169. In Farsi.
Bakhshi, F., Najdegerami, E. H., Manaffar, R., Tukmechi, A. and Rahmani Farah, K. 2019. Evaluation of chemical, microbiological and sensory traits of common carp meat in biofloc system. Journal of Veterinary Research, 74(1):55-64. In Farsi.
Bakhshi, F., Rahmani Farah, K., Najdegerami, E. H., Manaffar, R. and Tukmachi, A. 2018. Chemical and quality indices of common carp meat reared in the Biofloc system during the refrigerated storage time. Journal of Fisheries Science and Technology, 7(1):41-48. In Farsi.
Bakhshizod-Mahmoodi, A. 1996. Different methods of fishing in the inland waters of Gilan Province. Abzeeyan, Tehran, 7(10):39-41. In Farsi.
Bakht Azad, S., Paknezhad, H., Hosseinifar, S. H. and Hajimoradloo, A. M. 2020. Effects of different levels of dietary lysozyme on growth performance, serum and blood biochemical parameters in common carp (*Cyprinus carpio*). Journal of Animal Environment, 12(1):277-284. In Farsi.
Bahktiari, F. 2020a. Parishan Wetland: West Asia’s largest freshwater at drought tipping point. Tehran Times, 20 July 2020.
Bakhtiari, F. 2020b. Geno Biosphere Reserve: elevation variability comes with unique diversity. Tehran Times, 13 September 2020.
Bakhtiarian, H., Abdoli, A. and Pazooki, J. 2008. Inter-population variation of *Capoeta buhsei* in central basin of Iran. International Conference on Biodiversity Conservation and Management, University of Science and Technology, Cochin, Kerala, India, 3-6 February 2008 (abstract).
Balali, H., Mehrgan, N., Haj Abedi, N. and Bani Asadi, M. 2019. Investigating of the long-term and short-term effects of rainfall changes on the value added of Iranian aquaculture and fisheries sector. Iranian Scientific Fisheries Journal, 28(5):57-66. In Farsi.
Balasem, A. N., Dalli, F. A. and Mutar, A. J. 1994. Karyotyping of *Barbus sharpeyi*. Cytobios, 78(314):177-180.
Balık, S., Ustaoğlu, M. R., Sarı, H. M. and Özbek, M. 1996. Kuş Gölündeki (Bandırma) Tatlısu Kolyozu (*Chalcalburnus chalcoides* Güldenstaedt, 1772) Populasyonunun Biyolojik Özelliklerinin İncelenmesi [Investigations on biological characteristics of the Danube bleak (*Chalcalburnus chalcoides* Güldenstaedt, 1772) population in Lake Kuş (Bandırma)]. Su Ürünleri Dergisi, 13(1-2):171-182.
Balletto, E. and Spanò, S. 1977. Ciprinidi del genere *Garra* Hamilton 1822, raccolti nello Yeman dal Prof. Giuseppe Scortecci. Annali del Museo Civico di Storia Naturale “Giacomo

Doria”, Genova, 81:246-287.
Balon, E. K. 1974. Domestication of the carp *Cyprinus carpio* L. Royal Ontario Museum Life Sciences Miscellaneous Publication, Toronto. 37 pp.
Balon, E. K. 1995. The common carp, *Cyprinus carpio*: its wild origin, domestication in aquaculture, and selection as colored nishikigoi. Guelph Ichthyology Reviews, 3:1-55.
Balon, E. K. 2006. The oldest domesticated fishes, and the consequences of an epigenetic dichotomy in fish culture. Aqua, Journal of Ichthyology and Aquatic Biology, 11(2):47-86.
Balouch, A., Shahsavani, D. and Maleki, M. 2010. Clinical and pathological study of long term bath of zinc sulfate on cutaneous healing in common carp (*Cyprinus carpio*). Journal of Veterinary Research, 65(1):31-35. In Farsi.
Baltz, D. M. 1991. Introduced fishes in marine systems and inland seas. Biological Conservation, 56(2):151-177.
Bampoori, R., Mirdar Harijani, J., Gharaei, A. and Jamshidian, A. 2021. Effect of deltamethrin insecticide on the blood serum enzymes and its histopathological on common carp (*Cyprinus carpio*). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 8 pp. In Farsi.
Banaee, M., Fallahpour, F., Soleimany, V. and Nematdoost Haghi, B. 2016. Preclinical toxicity and safety evaluation of *Althaea officinalis* L. extract as naturopathic medicine in common carp (*Cyprinus carpio* L.): Hematological and biochemical study. Journal of Applied Aquaculture, 28(2):92-109.
Banaee, M., Gorbani, M. and Naderi, M. 2014. The reproductive biology of golden barb (*Barbus luteu*s Heckel, 1843) in Maroon River, Iran. Journal of Aquatic Ecology, Hormozgan University, 4(2):35-46. In Farsi.
Banaee, M., Haghi, B. N. and Ibrahim, A. Th. A. 2013. Sub-lethal toxicity of chlorpyrifos on common carp, *Cyprinus carpio* (Linnaeus, 1758): Biochemical response. International Journal of Aquatic Biology, 1(6):281-288.
Banaee, M., Haghi, B. N. and Zoheiri, F. 2013. LC50 and bioaccumulation of lead nitrate (Pb(NO3)2) in goldfish (*Carassius auratus*). International Journal of Aquatic Biology, 1(5):233-239.
Banaee, M., Keihani, E. and Ahmadi, K. 2013. Histopathological changes caused by diazinon on kidney, intestine and gills of male goldfish (*Carassius auratus*). Journal of Utilization and Cultivation of Aquatics, 2(3):77-98. In Farsi.
Banaee, M., Mirvaghefi, A. R., Mojazi Amiri, B. and Rafiee, Gh. R. 2012. Biochemical characteristics of blood and histopathological study of experimental diazinon poisoning in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 65(2):119-133. In Farsi.
Banaee, M., Mirvaghefi, A. R., Mojazi Amiri, B., Rafiee, G. R. and Nematdost, B. 2011. Hematological and histopathological effects of diazinon poisoning in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 64(1):1-12. In Farsi.
Banaee, M. and Naderi, M. 2014. The reproductive biology of shirbot (*Barbus grypus* Heckel, 1843) in the Maroon River, Iran. International Journal of Aquatic Biology, 2(1):43-52.
Banaee, M., Nematdoost Haghi, B., Mohiseni, M. and Gholizade, B. 2016. The effect of yarrow (*Achillea millefolium* L.) extract on blood chemical parameters of common carp

(*Cyprinus carpio*) infected with *Aeromonas hydrophila*. Journal of Aquatic Ecology, Hormozgan University, 5(3):89-101. In Farsi.

Banaee, M., Nematdoost Haghi, B. and Shokat, P. 2016. Effect of administration of mint extract (*Mentha longifolia*) on blood biochemical parameters and growth performance in common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 10(3):39-55. In Farsi.

Banaee, M., Sharifinasab, Z., Moheiseni, M. and Noori, A. 2018. Protective effects of vitamin C and chitosan against changes in the biochemical parameters in gill cells of common carp (*Cyprinus carpio*) exposed to paraquat. Journal of Aquaculture Development, 12(1):23-34. In Farsi.

Banaee, M., Sureda, A., Zohiery, F., Hagi, B. N. and Garanzini, D. S. 2014. Alterations in biochemical parameters of the freshwater fish, *Alburnus mossulensis*, exposed to sub-lethal concentrations of Fenpropathrin. International Journal of Aquatic Biology, 2(2):58-68.

Banaee, M., Tahery, S., Nematdoost Haghi, B., Shahafve, Sh. and Vaziriyan, M. 2019. Blood biochemical changes in common carp (*Cyprinus carpio*) upon co-exposure to titanium dioxide nanoparticles and paraquat. Iranian Journal of Fisheries Sciences, 18(2):242-255.

Banaee, M., Tahery, S., Vaziriyan, M., Shahafve, S. and Nemadoost-Haghi, B. 2015. Reproductive health indicators of immature common carp exposed to municipal wastewater of Behbahan, Iran. Journal of Advances in Environmental Health Research, 3(3):164-171.

Banaee, M., Vaziriyan, B., Derikvandy, A., Nematdoost Haghi, B. and Mohiseni, M. 2019. Biochemical and physiological effects of dietary supplements of ZnO nanoparticles on common carp (*Cyprinus carpio*). International Journal of Aquatic Biology, 7(12):56-64.

Banaei M., Mirvaghefi, A. R., Ahmadi, K. and Ashouri, R. 2009. The effect of diazinon on histopathological changes of testis and ovaries of common carp (*Cyprinus carpio*). Journal of Marine Biology, 1(2):14-25. In Farsi.

Banagar, G. R., Kiabi, B. H., Homayoonnezhad, I., Piri, I. and Amirian, P. 2008. Biodiversity of fish species in Haraz River (an ecological approach). World Applied Sciences Journal, 5(1):5-11.

Banagar, Gh. R., Rahmani, H., Ajorlo, M. and Golmohammadi, S. 2013. Comparison of copper concentrations in liver and muscle of *Squalius cephalus* and *Capoeta capoeta gracilis* (Pisces: Teleostei) in Tajan River, Iran. Caspian Journal of Environmental Sciences, 11(2):247-253.

Banagar, Gh. R., Rahmani, H., Golmohammadi, S. and Moghaddas, D. 2011. Comparison of Cd heavy metal accumulation in muscle and liver tissues of *Capoeta capoeta* in Tajan River in Mazandaran. Journal of Aquatic Animals and Fisheries, 1(4):21-29. In Farsi.

Banagar, Gh. R., Karami, M., Hasanzadeh Kiabi, B. and Ghasempouri, S. M. 2009. Distribution and biodiversity of fish species in Haraz River in Mazandaran Province. Environmental Sciences, 6(2):21-31. In Farsi.

Banan Khojasteh, S. M., Ebrahimi, S., Ramezani, M. and Haghnia, H. 2009. The histological and histochemical study on the esophagus and intestine in common carp fish (*Cyprinus carpio* Linnaeus (1758)). Journal of Animal Biology, 1(4):18-26. In Farsi.

Banan Khojasteh, S. M., Seif Reihani, M. R. and Rahimi Bashar, M. R. 2012. The study of fishes fauna of the Aharchay River in Eastern Azerbaijan Province. Journal of Animal Biology, 4(3):11-19. In Farsi.

Banarescu, P. 1960. Einige Fragen zur Herkunft und Verbreitung der Süβwasserfischfauna der europäisch-mediterranen Unterregion. Archiv für Hydrobiologie, 57(1/2):16-134.

Banarescu, P. 1961. Weitere systematische Studien über die Gattung *Gobio* (Pisces, Cyprinidae) insbesondere im Danaubecken. Věstník československé Společnosti zoologické, 25(4):318-416.

Bănărescu, P. 1969. Characterisation of world freshwater fish faunas according to Mayr (1965)'s schema. Revue Roumaine de Biologie, Zoologie, Bucarest, 14(1):9-15.

Bănărescu, P. 1970. Die Fische des pontokaspischen potamophilen Artenkomplexes und die karparto-kaukasische Disjunktion. Hidrobiologia, Bucarest, 11:135-141.

Bănărescu, P. 1973. Some reconsiderations on the zoogeography of the Euro-Mediterranean fresh-water fish fauna. Revue Roumaine de Biologie, Zoologie, Bucarest, 18(4):257-264.

Banarescu, P. 1976. Position zoogéographique de l'ichthyofaune d'eau douce de l'Asie occidentale. Revue des Travaux de l'Institut des Pêches maritimes, 40(3 et 4):486-487.

Banarescu, P. 1977. Position zoogéographique de l'ichthyofaune d'eau douce d'Asie occidentale. Cybium, 3(2):35-55.

Bănărescu, P. M. 1986. A review of the species of *Crossocheilus*, *Epalzeorhynchos* and *Paracrossocheilus* (Pisces, Cyprinidae). Travaux du Muséum d'Histoire naturelle "Grigore Antipa", Bucarest, 28:141-161.

Banarescu, P. M. 1989. Vicariant patterns and dispersal in European freshwater fishes. Spixiana, 12(1):91-103.

Bănărescu, P. M. 1991. The subspecies in freshwater ichthyology. Evolution and Adaptation, Cluj, 4:183-190.

Bănărescu, P. M. 1992a. A critical updated checklist of Gobioninae (Pisces, Cyprinidae). Travaux du Muséum d'Histoire naturelle "Grigore Antipa", Bucarest, 32:303-330.

Bănărescu, P. 1992b. Zoogeography of Fresh Waters. Volume 2. Distribution and Dispersal of Freshwater Animals in North America and Eurasia. AULA-Verlag, Wiesbaden. pp. 519-1091.

Bănărescu, P. 1995. Zoogeography of Fresh Waters. Volume 3. Distribution and Dispersal of Freshwater Animals in Africa, Pacific Areas and South America. AULA-Verlag, Wiesbaden. pp. 1092-1617.

Bănărescu, P. M. 1997. The status of some nominal genera of Eurasian Cyprinidae (Osteichthyes, Cypriniformes). Revue Roumaine de Biologie, Série de Biologie Animale, 42(1):19-30.

Bănărescu, P. M. (Ed.). 1999. The Freshwater Fishes of Europe. Volume 5. Cyprinidae 2. Part I: *Rhodeus* to *Capoeta*. AULA-Verlag, Wiebelsheim. xviii + 427 pp.

Bănărescu, P. M. and Bogutskaya, N. G. (Eds.). 2003. The Freshwater Fishes of Europe. Volume 5/II. Cyprinidae 2. Part II: *Barbus*. AULA-Verlag, Wiebelsheim. x + 454 pp.

Bănărescu, P. and Coad, B. W. 1991. Cyprinids of Eurasia, Chapter Five, pp. 127-155, 1 figure, 1 table. In: Winfield, I. J. and Nelson, J. S. Cyprinid Fishes. Systematics, biology and exploitation. Chapman & Hall, London. 667 pp., 132 illustrations. (Fish and Fisheries Series, 3).

Banarescu, P. M. and Herzig-Straschil, B. 1995. A revision of the species of the *Cyprinion macrostomus*-group (Pisces: Cyprinidae). Annalen des naturhistorischen Museums in Wien, 97B:411-420

Banarescu, P. and Nalbant, T. 1973. Pisces, Teleostei, Cyprinidae (Gobioninae). Das Tierreich, Berlin, 93:vii + 304 pp.

Bănărescu, P. M. and Paepke, H-J. (Eds.). 2002. The Freshwater Fishes of Europe. Volume 5/III. Cyprinidae 2. Part III: *Carassius* to *Cyprinus*. Gasterosteidae. AULA-Verlag, Wiebelsheim. xi + 305 pp.

Bandani, G. 2006a. Studying quality and quantity of fingerling of some bony fish. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).

Bandani, G. 2006b. Survey of biological condition of fingerlings released into Gorgan-rood. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry Jihad-e-Agriculture. http://en.ifro.ir (abstract).

Bandani, Gh. 2016. The stock assessment of bony fish, carp (*Cyprinus carpio*) and roach (*Rutilus rutilus*) in southern coast of the Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 34 pp. In Farsi.

Bandani, Gh., Larijani, M., Abbasi, K., Keymaram, F. and Jabaleh, A. R. 2017. Nutritional behaviour of common carp *Cyprinus carpio* Linnaeus, 1758 in Iranian waters of Caspian Sea. Journal of Applied Ichthyological Research, 5(3):15-26. In Farsi.

Bandani, Gh., Larijani, M., Fazli, H. and Daryanabard, G. 2018. Population dynamics of bony fish carp (*Cyprinus carpio*) and roach (*Rutilus lacustris*) in southern coast of the Caspian Sea. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Bandani, Gh. A. 2016. The study of biology (age, feeding and, reproduction of *Rutilus rutilus caspicus* in south coast of the Caspian Sea (Iranian waters). Iranian Fisheries Science Research Institute, Tehran. 48 pp. In Farsi.

Bandani, Gh. A., Khoshbavar Rostami, H. A., Yelghi, S., Shokrzadeh, M. and Nazari, H. 2011. Concentration of heavy metals (Cd, Cr, Zn, and Pb) in muscle and liver tissues of common carp (*Cyprinus carpio* L., 1758) from coastal waters of Golestan Province. Iranian Scientific Fisheries Journal, 19(4):1-10. In Farsi.

Bandani, Gh. A., Larijani, M., Fazli, H. and Daryanabard, Gh. R. 2020. Analyzing the trend of catch rate and reconstruction of carp and roach in the Iranian waters of Caspian Sea. Journal of Utilization and Cultivation of Aquatics, 9(2):45-56. In Farsi.

Bandany, Gh., Yelghi, S. and Ghorbani, R. 2010. Reproductive biology of (Cyprinus carpio, Linnaeus 1758) in south coastal line Caspian Sea (Iranian waters). 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Bani, A., Haghi, A. and Naser-Alvavi, G. 2014. The effects of salinity on plasma levels of cortisol, glucose and sex steroids in kutum (*Rutilus frisii kutum*). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Bani, A. and Haghi Vayghan A. 2010. Temporal variations in haematological and biochemical indices of the Caspian kutum, *Rutilus frisii kutum*. 1st National-Regional Conference on Ecology of the Caspian Sea (FCECS2010), 1-2 June 2010, Sari.

Bani, A., Haghi Vayghan, A. and Alavi, M. Gh. 2014. The effects of salinity on plasma levels of cortisol, glucose and sex steroids in Caspian kutum *Rutilus frisii kutum*. 2nd International Conference on the Persian Gulf Oceanography and 10th Conference of Iranian Marine Science and Technology, 18-19 February 2014, Tehran.

Bani, A., Haghi Vaygahn, A. and NaserAlavi, M. 2016. The effects of salinity on reproductive performance and plasma levels of sex steroids in Caspian kutum *Rutilus frisii kutum*. Aquaculture Research, 47(10):3119-3126.

Bani, A., Lotfi Chahardeh, M. and Ghorbankhah Moridani, M. 2020. Comparison of otolith microchemistry of reproductive and non-reproductive female kutum (*Rutilus frisii kutum*). Aquatic Physiology and Biotechnology, 8(2):1-18. In Farsi.

Bani, A., Toorchi, M. and Norouzi, N. 2015. Morphometric and meristic variations in bream (*Abramis brama orientalis*, Berg, 1949) during larval development. Caspian Journal of Environmental Sciences, 13(2):89-97.

Bani, A. and Vayghan, A. H. 2011. Temporal variations in haematological and biochemical indices of the Caspian kutum, *Rutilus frisii kutum*. Ichthyological Research, 58(2):126-133.

Banimasani, M., Keivany, Y. and Ebrahimi, E. 2018. Comparative study of *Capoeta barroisi* populations in Qomrud, Kor and Sheldon rivers using meristic and geometric morphometric data. Journal of Animal Environment, 10(1):145-152. In Farsi.

Banimasani, M., Keivany, Y. and Ebrahimi, E. 2019. Comparative geometric morphometric study of *Capoeta fusca* populations Kavir and Harirud basins. Journal of Experimental Animal Biology, 7(4):107-115. In Farsi.

Banister, K. E. 1980. The fishes of the Tigris and Euphrates rivers, pp. 95-108. In: Rzóska, J. Euphrates and Tigris, Mesopotamian ecology and destiny. Monographiae Biologicae, 38:x + 122 pp.

Banister, K. 1992. Blind cave fishes. Aqua Geõ-graphia, 2:65-73.

Banister, K. E. and Bunni, M. K. 1980. A new blind cyprinid fish from Iraq. Bulletin of the British Museum (Natural History) Zoology, 38(3):151-158.

Banister, K. E. and Clarke, M. A. 1977. The freshwater fishes of the Arabian Peninsula. Journal of Oman Studies, Special Report, 1:111-154, 1 map.

Baqeri, O. 2000. Chaghakhor Wetland and its general characteristics. Moj-e Sabz, Tehran, 1:36-38. In Farsi (English translation at www.netiran.com/Htdocs/Clippings/Social/201209XXSO01.html, downloaded 15 December 2000).

Barach, G. P. 1934. K sistematike i geograficheskomu rasprostraneniyu kavkazskikh golavlei. 1. Istoricheskii ocherk isucheniya kavkazskikh golavlei [On the systematics and geographical distribution of the Caucasian chubs. 1. Historical sketch of the Caucasian chubs studied]. Trudy Zoologicheskogo Sektora, Akademiya Nauk SSSR, Zakavzkazskii Filial Gruzinskoe Otdelenie, 1:91-133.

Barach, G. P. 1939. Ryby presnykh vod Abkhazii [Freshwater fishes of Abkhazia]. Materialy po fauna Abkhazii, izdanie Gruzinskogo filiala Akademii Nauk, Tbilisi, 1939:45-114.

Barach, G. P. 1940. Ryby Armenii [The fishes of Armenia]. Trudy Sevanskoi Gidrobiologicheskoi Stantsii, 6:5-70.

Barach, G. P. 1941. Fauna Gruzii, T. I. Ryby presnykh vod [Fauna of Georgia, Volume 1. Freshwater Fishes]. Izvestiya Akademii Nauk Gruzinskoi SSR, Tbilisi. vii + 288 pp.

Baradaran Noveiri, Sh. and Hassanzadeh Saber, M. 2018. Methods of sperm quality assessment in fishes. Journal of Aquaculture Development, 12(3):15-29. In Farsi.

Baradaran Noveiri, Sh., Pourkazemi, M., Kouchinian, P. and Yavari, V. 2002. The effects of cryopreservation on movement patterns of carp (*Cyprinus carpio*) spermatozoa. Pajouhesh va Sazandegi, 15(2)(55):6-10. In Farsi.

Baradaran Noveiri, Sh., Pourkazemi, M., Kouchinian, P. and Yavari, V. 2006. Cryopreservation of carp spermatozoa by different extenders. Iranian Scientific Fisheries Journal, 14(4):17-30. In Farsi.

Barak, N. A. A. and Mohamed, A-R. M. 1982. Food habits of cyprinid fish, *Barbus luteus* (Heckel). Iraqi Journal of Marine Science, Basrah, 1(1):59-66.

Barak, N. A. A. and Mohamed, A-R. M. 1983. Biological study of the cyprinid fish, Barbus luteus (Heckel) in Garma Marshes. Journal of Biological Sciences Research, Baghdad, 14(2):53-70.

Barak, N. A. A. and Mohamed, A. M. 1985. The growth of carp (*Barbus sharpeyi* Gunther). Kuwait Bulletin of Marine Science, 6:257-262. In Arabic.

Baraki Tabar, S., Peyghan, R. and Razi Jalali, M. 2016. Effect of metronidazole and levamisole on some of serum biochemical factors and enzymes of common carp. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Baramaki Yazdi, R., Ebrahimpour, M., Mansouri, B., Rezaei, M. R. and Babaei, H. 2012. Contamination of metals in tissues of *Ctenopharyngodon idella* and *Perca fluviatilis*, Anzali Wetland, Iran. Bulletin of Environmental Contamination and Toxicology, 89(4):831-835.

Baramaki Yazdi, R., Rezaei, M., Ebrahimpour, M., Babaei, H. and Pourkhabbaz, A. 2015. Compersion (*sic*) of bioaccumulation factor of heavy metals in two fish species (*Esox lucius* and *Carassius gibelio*) from Anzali Wetland. Journal of Wetland Ecobiology, 7(2):79-90. In Farsi.

Barari, A., Abbaszade, M. M., Farnia, R., Mohammadi Futemi, T., Pakzad Soraki, M., Fallah, N. and Imanpur, M. 2017. Camparison (*sic*) of effects of different enzymic levels immnowall indices of growth, survival rate and body composition in (*Rutilus frisii kutum*) fingerlings. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 168-173. In Farsi.

Barari, A., Abbaszade, M. M., Farnia, R., Mohammadi Futemi, T., Pakzad Soraki, M., Pnahi Sahebi, H. and Imanpur M. 2017. Camparison (*sic*) of effects of different enzymic levels preimalac indices of growth, survival rate and body composition in (*Rutilus frisii kutum*) fingerlings. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 239-244. In Farsi.

Barari, A., Abbaszadeh, M. M., Farnia, R., Mohammadi Fotemi, T., Pakzad Soraki, M., Niloofar, F. and Imanpour M. 2017. Comparison of effects in different enzymic levels immunowall indices of growth, survival rate and body composition in (*Rutilus firisii kutum*) (*sic*) fingerlings. Breeding and Aquaculture Sciences Quarterly, 5(14):11-20. In Farsi.

Barati, A., Javan, S. and Sehhatisabet, M. E. 2008. Reproductive biology of pygmy cormorant *Phalacrocorax pygmeus* in Siahkeshim Protected Area, Northern Iran. Marine Ornithology, 36(2):163-166.

Barčák, D., Oros, M., Hanzelová, V. and Scholz, T. 2017. A synoptic review of *Caryophyllaeus* Gmelin, 1790 (Cestoda: Caryophyllidea), parasites of cyprinid fishes. Folia Parasitologica, 64:027.

Barghaman, H., Yeganeh, S. and Keramat Amirkolaie, A. 2019. Effect of probiotic *Lactobacillus lactis* (PTCC 1403) and chitin on blood and serum biochemical parameters and intestine bacteria of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 28(5):143-156. In Farsi.

Barghi Lashkari, E., Rajabi Islami, H. and Salehi, H. 2017. Effective factors in production and marketing of ornamental fish in Alborz Province. Journal of Aquaculture Development, 11(2):1-12. In Farsi.

Barimani, A. 1960-1961. Fishes of the Caspian Sea. Game and Nature, Tehran, 5:60-65; 6:70-75; 7:58-62; 8:72-77; 9:56-64; 10:68-70; 11:8-9; 12:58-61; 13:64-66; 15:64-67; 18:52-57. In Farsi.

Barimani, A. 1961a. The history of Shilot Fishing Company and its fishes in the Mazanderan Sea. Game and Nature, Tehran, 14:64-68. In Farsi.

Barimani, A. 1961b. The fish foods. Game and Nature, Tehran, 19:50-55 In Farsi.

Barimani, A. 1966. Ichthyology and fisheries. Tehran University Press, Tehran. In Farsi.

Barimani, A. 1977. The Caspian Sea. University of Tehran, Tehran. Volume I. 302 pp. In Farsi.

Barkhordari, J. 2003. Assessing the effects of land use change on the hydrologic regime by RS and GIS. A case study in the Minab catchment, Hormozgan province, Iran. M.Sc. Thesis, International Institute for Geo-information Science and Earth Observation, Enschede, The Netherlands. xii + 71 pp.

Barmar, M., Mohammadi, H., Ghaderi, E. and Zadmajid, V. 2020. Diet preference of doctor fish (*Garra rufa*) in Gheshlagh reservoir basin of Kurdistan Province. The 7th Iranian Conference of Ichthyology, Lorestan University, 30-31 October 2019 (abstract).

Barrois, T. 1894. Contribution à l'étude de quelques lacs de Syrie. Revue biologique du nord de la France, 6(1893-1894):224-312.

Bartáková, V., Bryja, J., Šanda, R., Bektas, Y., Stefanov, T., Choleva, L., Smith, C. and Reichard, M. 2019. High cryptic diversity of bitterling fish in the southern West Palearctic. Molecular Phylogenetics and Evolution, 133:1-11.

Bartel, R., Epler, P. and Zdanowski, B. 1986. The development of fisheries in the Iraqi lakes Tharthar, Habbaniya and Razzazah. Gospodarka Rybna, 38(2/3):29-33. In Polish.

Barthold, W. 1984. An Historical Geography of Iran. Princeton University Press, Princeton. xv + 285 pp.

Bartley, D. M. and Rana, K. 1998a. Stocking inland waters of the Islamic Republic of Iran. FAO Aquaculture Newsletter, 18:16-19.

Bartley, D. M. and Rana, K. 1998b. Evaluation of artificial rehabilitation of the Caspian Sea fisheries and genetic resource management in aquaculture and fisheries of the Islamic Republic of Iran. Report prepared for Shilat (Fisheries Department), Ministry of Jihad-e-Sazandagi, Islamic Republic of Iran, Food and Agriculture Organization, Rome, 35 pp.

Barzegar, M. 2005. Crustacean parasites of cultured and wild fishes of Iran and Caspian Sea: a review. Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Barzegar, M., Asadollah, S., Hemmat-Zadeh, A., Jalali, B. and Rahnama, R. 2004. Parasites of fishes in Behesht-Abad River (Chaharmahal-o-Bakhtiary). Iranian Journal of Veterinary Science, 1(1):67-74. In Farsi.

Barzegar, M., Ebrahimzadeh Mousavi, H., Rahmati-holasoo, H., Taheri Mirghaed, A. and Bozorgnia, A. 2018. *Gyrodactylus* (Monogenea, Gyrodactylidae) parasite fauna of fishes in some rivers of the southern Caspian Sea basin in Mazandaran province. Iranian Journal of Veterinary Medicine, 12(1):35-44.

Barzegar, M. and Jalali, B. 2002. Parasites of Kaftar Lake fishes, their geographical distribution and economical importance. Science Journal of the School of Veterinary Medicine, Shahid Chamran University, Ahvaz, 3(5):52-64. In Farsi.

Barzegar, M. and Jalali, B. 2009. Crustacean parasites of fresh and brackish (Caspian Sea) water fishes of Iran. Journal of Agricultural Science and Technology, 11:161-171.

Barzegar, M. and Jalali Jafari, B. 2006. Helminthes, Acanthocephala and Crustacean parasites of

fishes in Vahdat Reservoir. Iranian Journal of Veterinary Sciences, 3:229-234. In Farsi.
Barzegar, M., Raeisi, M., Bozorgnia, A. and Jalali, B. 2008. Parasites of eyes of fresh and brackish water fishes in Iran. Iranian Journal of Veterinary Research, Shiraz University, 9(3)(24):256-261.
Barzegar Dolatabadi, M. and Bozorgnia, A. 2019. Checklist of the parasites of fishes in Iran. Noruzi Publishing, Tehran.
Basak Kahkesh, F., Salehi, H., Amiri, F. and Nikpey, M. 2010. Integration of benni (*Barbus sharpeyi*) with Chinese carps and economic comparison with custom cultivation way. Journal of Fisheries, 4(3)(15):73-84. In Farsi.
Basak Kahkesh, F., Yavari, V., Eskandari, G. R. and Mohammadi, G. H. 2010. Effects of weight and length of *Barbus grypus* broodstock on fingerlings production and growth. Iranian Scientific Fisheries Journal, 19(2):1-8. In Farsi.
Basak Kahkesh, F., Yavari, V., Eskandari, Gh. R., Mohammadi, Gh. H., Amiri, F. and Nikpey, M. 2011. The effect of size of *Barbus grypus* broodstock on reproductive indices, functional fecundity, fertilization rate, hatch rate and larvae survival rate. Journal of Fisheries, 5(3):81-90. In Farsi.
Bashirzade Hengami, S. and Oujifard, A. 2016. Investigation of Fe, Pb, Zn, Ni, Cu and Cd accumulation in tissues of common carp (*Cyprinus carpio*) of the Anzali Wetland. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Basir, Z., Morovvati, H., Khaksari, M., Mesbah, M. and Abdi, R. 2012. Histomorphology and histometric study of the head's skin in (*Barbus grypus*). Journal of Cell and Tissue, 3(1):73-81.
Basir, Z., Morovvati, H., Khaksari Mahaadi, M., Mesbah, M. and Abdi, R. 2011. Skin histomorphometry of *Barbus grypus* in base of dorsal fin and caudal peduncle sections. Journal of Animal Environment, 3(2):9-16. In Farsi.
Basir, Z. and Peyghan, R. 2019. Immunohistochemical and ultrastructural study of the effect of different salinities on gill chloride cells of *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 28(5):131-141. In Farsi.
Basir, Z., Peyghan, R., Ghorbanpoor, M. and Abdi, R. 2011. Study of changes in serum antibody after intra-peritoneal and intra-muscular injection of killed *Aeromonas hydrophila* on common carp (*Cyprinus carpio*). Journal of Animal Environment, 2(4)(8):19-24. In Farsi.
Baska, F. and Masoumian, M. 1996. *Myxobolus molnari* sp. n. and *M. mokhayeri* sp. n. (Myxosporea, Myxozoa) infecting a Mesopotamian fish, *Capoeta trutta* Heckel, 1843. Acta Protozoologica, 35(2):151-156.
Başkurt, S., Emiroğlu, Ö., Tarkan, A. S. and Vilizzi, L. 2015. The life-history traits of widespread freshwater fish species: the case of roach (*Rutilus rutilus*) Linnaeus, 1758) (Pisces: Teleostei) in water bodies at the southern limits of distribution. Zoology in the Middle East, 61(4):339-348.
Basseri Arghavani, H., Askary Sary, A. and Javaheri Baboli, M. 2019. Effect of dietary EDTA supplementation on reduction of heavy metals load in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 28(3):1-12. In Farsi.
Başusta, N. and Çiçek, E. 2006. Length-weight relationships for some teleost fishes caught in Atatürk dam lake on (*sic*) southeastern Anatolia, Turkey. Journal of Applied Ichthyology, 22(4):279-280.
Batmanglij, N. 1990. Food of Life. A Book of Ancient Persian and Modern Iranian Cooking and

Ceremonies. Mage Publishers, Inc., Washington, D.C. 247 pp.
Batmanglij, N. 1999. (Fish). iv. Fish as food, p. 672. In: Yarshater, E. (Ed.). Encyclopædia Iranica. Bibliotheca Persica Press, New York. Volume IX, Fascicle 6. Festivals VIII-Fish.
Battalgil, F. 1942. Contribution à la connaissance des poissons des eaux douces de la Turquie. Istanbul Üniversitesi Fen Fakültesi Mecmuasi, B, 7:287-306.
Battalgil, F. 1944. Nouveaux poissons des eaux douces de la Turquie. Istanbul Üniversitesi Fen Fakültesi Mecmuasi, B, 9(2):126-133.
Bauchot, M.-L., Daget, J. and Bauchot, R. 1990. L'ichtyologie en France au début du XIXe siècle. L'Histoire naturelle des Poissons de CUVIER et VALENCIENNES. Bulletin du Muséum national d'Histoire naturelle, Paris, 4e série, 12, section A, numéro 1, supplément:3-142.
Bavand Savadkohi, E., Khara, H., Yousefian, M., Nezami, Sh. A. and Ejraei, F. 2012. Determination of relationship between age with efficiency factors artificial propagation in Caspian Sea kutum (*Rutilus frisii kutum*, Kamenskii, 1901) spawners males in Shirood River. Journal of Fisheries, 6(1):43-56. In Farsi.
Bavand Savadkouhi, E. and Khara, H. 2017. Effect of age on reproductive performance of kutum, *Rutilus frisii* (Nordmann, 1840) in Shirood River, the southern coast of the Caspian Sea. Caspian Journal of Environmental Sciences, 15(3):205-212.
Bayçelebi, E. 2019. Taxonomic revision of genus *Squalius* distributed in Turkey. Ph.D. Thesis, Recep Tayyip Erdogan University, Institute of Science and Technology, Rize, Turkey. 135 pp.
Bayçelebi, E., Kaya, C., Turan, D., Ergüden, S. A. and Freyhof, J. 2018. Redescription of *Garra turcica* from southern Anatolia (Teleostei: Cyprinidae). Zootaxa, 4524(2):227-236.
Bayrami, A., Abtahi, B., Farajzadeh, M. A., Mohammadi, M., Rahnema, M. and Haghdoust, M. 2003. Salinity and major ions concentration in Noor area and Gorgan Bay of south Caspian Sea. Iranian Journal of Marine Sciences, 2(2-3):21-28, In Farsi.
Bazarganpour, K., Rahimibashar, M. R. and Zamini, A. 2017. Parameters of effect of different levels of multi-enzyme combo on hematological (*sic*) kutum (*Rutilus kutum*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Bazrafshan, E., Mostafapour, F. K., Esmaelnejad, M., Ebrahimzadeh, G. R. and Mahvi, A. H. 2016. Concentration of heavy metals in surface water and sediments of Chah Nimeh water reservoir in Sistan and Baluchestan province, Iran. Desalination and Water Treatment, 57(20):9332-9342.
Beaumont, P. 1968. Qanats on the Varamin Plain, Iran. Transactions of the Institute of British Geographers, 45:169-179.
Beaumont, P. 1971. Qanat systems in Iran. Bulletin of the International Association of Scientific Hydrology, 16(1):39-50.
Beaumont, P. 1973a. A traditional method of ground-water utilization in the Middle East. Ground Water, 11(5):23-30.
Beaumont, P. 1973b. River regimes in Iran. Occasional Papers (New Series, Department of Geography, University of Durham, 1:29 pp.
Beaumont, P. 1974. Water resource development in Iran. Geographical Journal, 140(3):418-431.
Beaumont, P. 1981. Water resources and their management in the Middle East, pp. 40-72. In: Clarke, J. I. and Bowen-Jones, H. (Eds.). Change and development in the Middle East.

Essays in Honour of W. B. Fisher. Methuen, London. xiii + 322 pp.
Beaumont, P. 1998. Restructuring of water usage in the Tigris-Euphrates basin: the impact of modern water management policies. Yale School of Forestry & Environment Studies Bulletin, 103:168-186.
Beaumont, P., Blake, G. H. and Wagstaff, J. M. 1976. The Middle East: A Geographical Study. John Wiley and Sons, London. xvii + 572 pp.
Beaumont, P., Bonine, M. and McLachlan, K. (Eds.). 1989. Qanats, Kariz, and Khattara: Traditional Water Systems in the Middle East and North Africa. The Middle East Centre, School of Oriental and African Studies, University of London and Middle East & North Africa Studies Press, Wisbech. xxii + 305 pp.
Beaumont, P. and Neville, J. H. 1968. Rice cultivation in Iran's Caspian lowlands. World Crops, December 1968, pp. 70-73.
Beavan, R. 1872. Descriptions of two imperfectly known species of cyprinoid fishes from the Punjab, India. Proceedings of the Zoological Society of London, 1872:150-153.
Beckett, P. H. T. 1951. Waters of Persia. Geographical Magazine, 24:230-240.
Beckett, P. 1952. Qanāts in Persia. Journal of the Iran Society, London, 1(4):125-133.
Beckett, P. 1953. Qanats around Kirman. Royal Central Asian Journal, 40(1):47-56.
Beckett, P. 1966. The city of Kerman, Iran. Erdkunde, 20(2):119-125.
Beckman, W. C. 1961. Inland fisheries biology (Caspian Sea). Food and Agriculture Organization, Rome, Technical Assistance Project Summary, 277-54:11 pp.
Beckman, W. C. 1962. The freshwater fishes of Syria and their general biology and management. Food and Agriculture Organization, Rome, Fisheries Biology Technical Paper, 8:v + 297 pp.
Beheshti, N., Yeganeh, S. and Adel, M. 2018a. Determination of mean lethal concentration (LC50) and anaesthetic effect of topped lavender essential oil (*Lavandula angustifolia*) on common carp (*Cyprinus carpio*) juveniles. Journal of Veterinary Research, 73(3):299-307. In Farsi.
Beheshti, N., Yeganeh, S. and Adel, M. 2018b. Comparative study of the effect of anesthetizer topped lavender essential oil (*Lavandula angustifolia*) with clove oil (*Eugenia caryophyllata*) on some hematological and serum biochemical parameters of common carp (*Cyprinus carpio*) juveniles. Iranian Scientific Fisheries Journal, 27(4):107-121. In Farsi.
Behmanesh, A. 2016. Study of Babolrood River's WQI in Mazandaran province, Iran. International Journal of Advanced Biotechnology and Research, 7(Special Issue 4):776-783.
Behmanesh, A. 2020. Evaluation of water quality of Babolrood and Kharoon rivers for aquatics and aquaculture based on BCWQI index. Journal of Animal Environment, 12(1):399-406. In Farsi.
Behmanesh, S., Chakmehdouz Gasemi, F., Dejandian, S., Hoseinjani, A., Bourani, M. S. and Maleki Shimali, S. 2017. Gene diversity and molecular phylogeny of two species of *Rutilus* genus (*Rutilus frisii kutum* and *Rutilus rutilus caspicus*) based on DNA sequencing of mitochondrial cytochrome *b* gene. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Behmanesh, S., Chakmehdouz Ghasemi, F., Hoseingani, A., Malaki Shomali, S. and Dejandian, S. 2017. Population genetic of *Rutilus rutilus caspicus* using DNA sequencing in South Caspian Sea and Aras Lake. The Fifth Iranian Conference of Ichthyology, Islamic Azad

University of Babol, 13-14 December 2017 (abstract).
Behmanesh, Sh., Hosseinzade Sahafi, H., Abdolhai, H. and Sepahdary, A. 2017. Problems and obstacles of warm-water fish farming on northern Alborz Region with emphasis in Guilan Province. Journal of Aquaculture Development, 11(1):9-24. In Farsi.
Behnia, A. 1988. Qanat: Construction and maintenance. Centre for University Publications, Tehran. In Farsi. (4th Edition, 2000, 236 pp.).
Behnke, R. J. 1975a. Efficacy of the grass carp for vegetation control and the potential environmental impact of their introduction. MS, 7 pp.
Behnke, R. J. 1975b. Fishes from the qanats of Iran. Abstract, 55th Annual Meeting, American Society of Ichthyologists and Herpetologists, Williamsburg, Virginia, 8-14 June 1975. p. 75.
Behrens-Chapuis, S., Herder, F., Esmaeili, H. R., Freyhof, J., Hamidan, N. A., Özuluğ, M., Šanda, R. and Geiger, M. F. 2015. Adding nuclear rhodopsin data where mitochondrial COI indicates discrepancies - can this marker help to explain conflicts in cyprinids? DNA Barcodes, 3(1):187-199.
Behrouzi, Sh., Farabi, S. M. V. and Hedayatifard. M. 2014. The survey effect of salinity performed on survival rate and biological changes in kidney tissues of *Rutilus frisii kutum* juvenile. Veterinary Journal (Pajouhesh va Sazandegi), 107:31-37. In Farsi.
Behrouzirad, B. 2005. Fish-eating bird's diversity of south coast of Caspian Sea. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', 8-10 September 2004, Shahr-e Kord, Iran (abstract).
Behrouzirad, B. 2007. Identification of fish-eating birds. International Journal of Environmental Research, 1(2):88-95.
Behrouzirad, B., Rasekh, A. and Navidi, M. 2013. An estimation of consumption amount of fish by Great Cormorant (*Phalacrocorax carbo*) on fish culture pools in Shooshtar area (Khouzestan). Journal of Wetland Ecobiology, 5(3):17-30. In Farsi.
Behtash, N., Nazari Khoorasghani, M. and Nazari Khorasgani, Z. 2011. Assessment of pesticide residue levels in Sardab River in Mazandaran Province, Iran. Toxicology Letters, 205 (Supplement):S228.
Behzadi, S. 1991. A study on embryonic development stages of kutum (*Rutilus frisii kutum*). M.Sc. Thesis, Shomal Branch, Islamic Azad University, Tehran.
Behzadi Mackvandi, B., Borghei, A. M., Javadi, A., Minaei, S. and Almassi, M. 2015. Determination of biometric parameters of fish by image analysis. Journal of Biodiversity and Environmental Sciences, 6(2):272-276.
Beigichamforest, J., Hajimoradlou, A. M. and Paknejad, H. 2019. Effect of dietary orange peel (*Citrus sinensis*) powder addition on growth performance in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 7(4):21-28. In Farsi.
Beikzadeh, A., Imanpoor, M. R. and Taghizadeh, V. 2015. Effect of oral cortisol on growth, survival rate, hematocrit and biochemical blood parameters in common carp (*Cyprinus carpio*). Journal of Animal Environment, 7(1):259-266. In Farsi.
Beikzadeh Takori, A., Imanpoor, M. and Taghizadeh, V. 2015. The effect of salinity stress on chloride cell and cell histopathology of common carp (*Cyprinus carpio*) fed with oral cortisol. Journal of Animal Biology, 7(2):13-24. In Farsi.
Bektas, Y., Aksu, I., Kaya, C., Baycelebi, E., Atasaral, S., Ekmekci, F. G. and Turan, D. 2019. Phylogeny and phylogeography of the genus *Alburnoides* (Teleostei, Cyprinidae) in Turkey based on mitochondrial DNA sequences. Mitochondrial DNA Part A, 30(7):794-

805.
Bektas, Y., Aksu, I., Kaya, C. and Turan, D. 2019. DNA barcoding of the genus *Capoeta* (Actinopterygii: Cyprinidae) from Anatolia. Turkish Journal of Fisheries and Aquatic Sciences, 19(9):739-752.
Bektaş, Y., Beldüz, A. O. and Turan, D. 2013. The phylogenetic position of Turkish population within the European bitterling, *Rhodeus amarus* (Osteichthyes: Cyprinidae). Zoology in the Middle East, 59(1):39-50.
Bektas, Y., Turan, D., Aksu, I., Ciftci, Y., Eroglu, O., Kalayci, G. and Belduz, A. O. 2017. Molecular phylogeny of the genus *Capoeta* (Teleostei: Cyprinidae) in Anatolia, Turkey. Biochemical Systematics and Ecology, 70:80-94.
Bell, A. (Director). 1977. The world about us: a fish called Smith is alive and well and living in Persia. BBC2 Bristol, film transmitted 17 July 1977.
Belyaev, V. N. 1929. <u>Abramis</u> <u>sapa</u> <u>bergi</u> subs. nova. Podvid beloglazki iz yuzhnogo Kaspiya [<u>Abramis</u> <u>sapa</u> <u>bergi</u> subs. nova. A new subspecies of the white-eyed bream from the south Caspian]. Izvestiya Bakinskoi Ikhtiologicheskoi Laboratorii, Baku, 2(2):80-98.
Bémont, F. 1961. L'irrigation en Iran. Annales de Géographie, 70(377):597-620.
Benovics, M., Nejat, F., Abdoli, A. and Šimková, A. 2021. Molecular and morphological phylogeny of host-specific *Dactylogyrus* parasites (Monogenea) sheds new light on the puzzling Middle Eastern origin of European and African lineages. Parasites & Vectors. 14:372.
Benzer, S. Ş., Gül, A. and Yılmaz, M. 2009. Growth properties of tench (*Tinca tinca* L., 1758) living in Hirfanlı Reservoir (Kırşehir, Turkey). Iranian Journal of Fisheries Sciences, 8(2):219-224.
Benzer, S. Ş., Gül, A. and Yılmaz, M. 2011. Breeding properties of *Tinca tinca* (L., 1758) living in Kapulukaya Reservoir (Kırıkkale, Turkey). Iranian Journal of Fisheries Sciences, 10(3):375-382.
Berberian, M. and King, G. C. P. 1981a. Towards a paleogeography and tectonic evolution of Iran. Canadian Journal of Earth Sciences, 18:210-265.
Berberian, M. and King, G. C. P. 1981b. Towards a paleogeography and tectonic evolution of Iran: Reply. Canadian Journal of Earth Sciences, 18:1764-1766.
Berenjkar, N., Khalesi, M. K., Rahimi Mianji, G. and Farhadi, A. 2016. Discrimination between GH-2 and GH-1 genes in *Rutilus kutum* using sequencing and restriction enzymes. Journal of Fisheries (Iranian Journal of Natural Resources), 69(1):11-20. In Farsi.
Berenjkar, N., Khalesi, M. K., Rahimi Mianji, G. and Farhadi, A. 2018. Association between growth hormone gene polymorphism and growth traits in wild common carp, *Cyprinus carpio* from the Caspian Sea. Iranian Journal of Fisheries Sciences, 17(3):533-541.
Berg, L. S. 1898. K ikhtiofaune Aziatskoi Rossii. Ryby zakaspisskoi oblasti, sovrannye P. A. Varenstovym [On the ichthyofauna of Asiatic Russia. Fishes of the Transcaspian Province, collected by P. A. Varentsov]. Izvestiya Imperatorskago Obshchestva Lyubitelei Estestvoznaniya, Antropolgii i Etnografii pri Imperatorskom Moskovskom Universitete, Moskva, 86(2)(7):14-20.
Berg, L. S. 1905. Ryby Turkestana [Fishes of Turkestan]. Izvestiya Turkestanskogo Otdela Imperatorskogo Russkogo Geograficheskogo Obshchestva, 4:xvi + 261 pp., 6 pls.
Berg, L. S. 1911-1914. Fauna Rossii i sopredel'nykh stran. Ryby [Fauna of Russia and adjacent countries. Fishes]. Volume I. Marsipobranchii, Selachii and Chondrostei. iii + 337 pp., pl. I-VIII; Volume III. Ostariophysi. Book 1:336 pp., pl. I-II, Book 2:337-704, pl. III-VI.

Izdatel'stvo Akademii Nauk, St. Petersburg/Petrograd.
Berg, L. S. 1912. Faune de la Russie et des pays limitrophes fondés principalements sur les collections du Musée Zoologique de l'Académie Impériale des Sciences de St.-Pétersbourg. Poissons (Marsipobranchii et Pisces). Vol. III. Ostariophysi. Part 1. Imperatorskoj Akademii Nauk, St. Petersbourg. v. 3 (pt. 1):1-336, 2 pls. + pls. 1-2. In Russian.
Berg, L. S. 1914. Description of a new species of Garra (= Discognathus) from eastern Persia. Ezhegodnik Zoologicheskago Imperatorskoi Muzeya Akademii Nauk, St. Petersburg, 18(1913):61. In English.
Berg, L. S. 1916. Ryby presnykh vod Rossiiskoi imperii [Freshwater Fishes of the Russian Empire]. Moskva. xxvii + 563 pp.
Berg, L. S. 1925. Opisanie novogo vida roda Alburnus (Pisces) iz basseina Oz. Urmii [Description of a new species of the genus Alburnus (Pisces) from the basin of Lake Urmia]. Ezhegodnik Zoologischekogo Instituta Akademii Nauk SSSR, 26:213-214.
Berg, L. S. 1932a. Eine neue Barilius-Art (Pisces, Cyprinidae) aus Mesopotamien. Zoologischer Anzeiger, 100:332-334.
Berg, L. S. 1932b. Ryby presnykh vod SSSR i sopredel'nykh stran [Freshwater fishes of the USSR and adjacent countries]. 3rd Edition, Part 1. Vsesoyuznyy Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad. 543 pp.
Berg, L. S. 1933a. Note on *Cirrhina afghana* Günther (Pisces-Cyprinidae). Records of the Indian Museum, 35:193-196.
Berg, L. S. 1933b. Übersicht der Verbreitung der Süβwasserfische Europas. Zoogeographia, 1(2):107-208, 1 Karte.
Berg, L. S. 1934. Razdelenie Palearktiki na zoogeograficheskie oblasti na osnovanii rasprostraneniya presnovodnykh ryb [Zoogeographic divisions of the Palaearctic based on the distribution of freshwater fishes]. Trudy vsesoyuznogo Geograficheskogo, 1933(3):3-10, map.
Berg, L. S. 1936. Ryby basseina Atreka [Fishes of the Atreck basin]. Akademiya Nauk SSSR Trudy Soveta po Izucheniyu Proizvoditel'nykh Sil, Seriya Turkmenskaya, 6:241-253.
Berg, L. S. 1940. Zoogeografiya presnovodnykh ryb Perednei Azii [Zoogeography of freshwater fish of the Near East]. Uchenye Zapiski leningradskogo gosudarstvennogo Universiteta Seriya Geograficheskikh Nauk, 3:3-31.
Berg, L. S. 1948-1949. Freshwater fishes of the USSR and adjacent countries. Israel Program for Scientific Translations, Jerusalem (1962-1965). 3 volumes.
Berg, L. S. 1949. Presnovodnye ryby Irana i sopredel'nykh stran [Freshwater fishes of Iran and adjacent countries]. Trudy Zoologicheskogo Instituta Akademii Nauk SSSR, 8:783-858.
Berg, L. S. 1959. Vernal and hiemal races among anadromous fishes. Journal of the Fisheries Research Board of Canada, 16(4):515-537.
Berka, R. 1990. Inland capture fisheries of the USSR. Food and Agriculture Organization, Rome, Fisheries Technical Paper, 311:vi + 143 pp.
Berra, T. M. 1981. An Atlas of Distribution of the Freshwater Fish Families of the World. University of Nebraska Press, Lincoln. xxix + 197 pp.
Berra, T. M. 2001. Freshwater Fish Distribution. Academic Press, San Diego. xxxviii + 604 pp.
Berrebi, P. 1995. Speciation of the genus *Barbus* in the north Mediterranean basin: recent advances from biochemical genetics. Biological Conservation, 72(2):237-249.
Berrebi, P., Chenuil, A., Kotlík, P., Machordom, A. and Tsigenopoulos, C. S. 2014.

Disentangling the evolutionary history of the genus *Barbus sensu lato*, a twenty years adventure, pp. 29-55. In: Alves, M. J., Cartaxana, A., Correia, A. M. and Lopes, L. F. (Eds.). Professor Carlos Almaça (1934-2010) - Estado da Arte em Áreas Científicas que Desenvolveu. Museu Nacional de História Natural e da Ciência, Lisboa. 381 pp.

Berrebi, P., Kotlík, P. and Tsigenopoulos, C. S. 2001. Phylogeny of the polyphyletic genus *Barbus* (Cyprinidae): mtDNA to solve (nuclear) polyploid phyla organization. The 10th European Congress of Ichthyology ECI X, Programme & Book of Abstracts, Prague, Czech Republic, September 3-7, 2001. p. 26.

Berrebi, P., Kottelat, M., Skelton, P. and Ráb, P. 1996. Systematics of *Barbus*: state of the art and heuristic comments. Folia Zoologica, Brno, 45 (Supplement 1):5-12.

Bertin, L. and Estève, R. 1948. Catalogue des types de poissons du Muséum national d'Histoire naturelle, Paris, 4e Partie. Ostariophysaires (Cypriniformes). Paris. 117 pp.

Bertin, L. and Estève, R. 1950. Catalogue des types de poissons du Muséum national d'Histoire naturelle, Paris, 5e partie. Ostariophysaires (Siluriformes). Paris. 85 pp.

Bertram, G. C. L. 1944. A statement on the fisheries of Iran. Food and Agriculture Organization, Rome, FAO/53/1/976 and FAO 53/1/976 (A report made to the Middle East Supply Centre, mimeographed as pp. 87-90 of "The Fisheries of the Middle East. Reports dated: 1943 to 1949".

Besharat, K. and Khatib, S. 1993. Determination of the commercial catch region in Iranian coastal zone, 1990-1991. Final Report, Mazandaran Fisheries Research Center, Sari. 181 pp. In Farsi.

Besharat, K. and Rezvani Gilkolaei, S. 2006. Status of aquaculture in Islamic Republic of Iran. Country Report to the workshop on a regional approach for responsible development of marine farming in the Asia-Pacific Region, 6-11 March 2006, China PR. 11 pp.

Beshkar Dana, S., Moghaddasi, B. and Manouchehri, H. 2015. Dietary effects of the synbiotic biomin imbo on survival and growth performance of the oranda goldfish (*Carassius auratus*). Journal of Animal Biology, 7(2):1-12. In Farsi.

Besmel, A. R., Khara, H., Yousefian, M., Habibi, F. and Hosseinzadeh, M. 2010. Parasites of migratory kutum (*Rutilus frisii kutum*, Kamonsky (*sic*) 1901) brood stock to the Shazde River (Babolsar River (Mazandaran Province, Iran). Journal of Fisheries, 4(2):37-44. In Farsi.

Betancur-R, R., Wiley, E. O., Arratia, G., Acero, A., Bailly, N., Miya, M., Lecointre, G. and Orti, G. 2017. Phylogenetic classification of bony fishes. BMC Evolutionary Biology, 17:162.

Beygi, H. 2015. Impact of irrigation development and climate change on the water level of Lake Urmia, Iran. M.Sc. Thesis, Department of Physical Geography, Stockholm University. viii + 57 pp.

Beygi, M., Hajimoradloo, A., Hoseinifar, S. and Jafar, A. 2019. Effect of different levels of different rice (*sic* in English, Farsi reads dietary for last two words) beet molasses on blood indices of common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(3):227-230. In Farsi.

Beygi, M., Hajimoradloo, A., Hoseinifar, S. and Jafernoudeh, A. 2019. Effect of different levels of dietary beet molasses on some mucosal immunity parameters and serum biochemical parameters of common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(2):173-178. In Farsi.

Beyraghdar Kashkooli, O., Asadollah, S. and Ahmadi, Y. 2018. Age and growth assessment of

Chondrostoma regium (Heckel, 1843) (Teleostei: Cyprinidae) inhabiting the Zayandeh River (Iran) using different structures. Iranian Journal of Ichthyology, 5(2):118-125.

Beyraghdar Kashkooli, O., Asadollah, S. and Ahmadi, Y. 2019. A preliminary investigation of the relationship between otolith weight and age for *Chondrostoma regium* (Heckel, 1843) (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 6(2):106-111.

Beyraghdar Kashkooli, O., Gröger, J. and Núñez-Riboni, I. 2017. Qualitative assessment of climate-driven ecological shifts in the Caspian Sea. PLoS ONE, 12(5):e0176892.

Beytsayah, A., Mortezavizadeh, S. A., Jahedi, A. and Velayatzadeh, M. 2021. Some growth factors in larvae of *Labeo rohita*, *Catla catla* and *Cirrhinus mirgala* (*sic*) cultured in Khozestan province. New Technologies in Aquaculture Development (Journal of Fisheries), 14(4):1-15. In Farsi.

Bhattacharjee, P. C. and Dasgupta, M. 1988. Some observations on the biology of *Aspidoparia morar* (Ham.) from River Brahmaputra, Assam (India). Arquivos do Museu Bocage, nova série, 1(2):197-203.

Bhattacharya, S. 2015. Doctor fish *Garra rufa*: health and risk. Journal of Fisheries Sciences, 10(1):001-003.

Bhatti, M. N. and Al-Daham, N. K. 1978. Annual cyclical changes in the testicular activity of a freshwater teleost, *Barbus luteus* (Heckel) from Shatt-Al-Arab, Iraq. Journal of Fish Biology, 13(3):321-326.

Bhatti, M. N. and Mirza, M. R. 1995. Pakistan ki Nachhlian aur Mahi Parvari [Fish and Fisheries of Pakistan]. Part II. Ferozsons, Lahore. 309 pp. In Urdu.

Bianco, P. G. 1990. Potential role of the palaeohistory of the Mediterranean and Paratethys basins on the early dispersal of Euro-Mediterranean freshwater fishes. Ichthyological Exploration of Freshwaters, 1(2):167-184.

Bianco, P. G. 1995a. A revision of the Italian *Barbus* species (Cypriniformes: Cyprinidae). Ichthyological Exploration of Freshwaters, 6(4):305-324.

Bianco, P. G. 1995b. Factors affecting the distribution of freshwater fishes especially in Italy. Cybium, 19(3):241-259.

Bianco, P. G. and Banarescu, P. 1982. A contribution to the knowledge of the Cyprinidae of Iran (Pisces, Cypriniformes). Cybium, 6(2):75-96.

Bibak, M., Hosseini, S. A. and Izadpanahi, G. R. 2013a. Length-weight relationship of *Barbus grypus* (Heckel, 1843) in Dalaki River and *Garra rufa* (heckel (*sic*), 1843) in Shahpur River in south of Iran. World Journal of Fish and Marine Sciences, 5(2):203-205.

Bibak, M., Hosseini, S. A. and Izadpanahi, G. R. 2013b. Length-weight relationship of *Capoeta capoeta intermedia* (Bianco and Banarescu, 1982) in Shahpur River and Dalaki River in south of Iran. World Journal of Fish and Marine Sciences, 5(2):206-208.

Bibak, M., Hosseini, S. A. and Izadpanahi, G. R. 2013c. Length-weight relationship of *Cyprinion macrostomus* (Heckel, 1843) in Dalaki River and Shahpur River in south of Iran. World Journal of Fish and Marine Sciences, 5(3):263-265.

Bickham, J. W. 1996. Ecotoxicology in Azerbaijan. Quarterdeck, College Station, Texas, 4(3):7 pp. (internet version).

Bilen, S. and Müge Bilen, A. 2013. Effects of different protein sources on growth performance and food consumption of goldfish, *Carassius auratus*. Iranian Journal of Fisheries Sciences, 12(3):717-722.

Bilici, S., Baysal, A., Cicek, Y., Uysal, E. and Unlu, E. 2016. Morphological and meristic differences among freshwater fish, *Cyprinion kais* (Cyprinidae) populations in Tigris

River of southeast Turkey. Fresenius Environmental Bulletin, 25(10):4045-4051.
Bilici, S., Cicek, T., Baysal, A., Unlu, E. and Alp, A. 2015. Morphological differences among the *Cyprinion macrostomus* (Cyprinidae) populations in the Tigris River. Journal of Survey in Fisheries Sciences, 2(1):57-67.
Bilici, S., Çiçek, E. and Ünlü, E. 2017. Observation on the age, growth and somatic condition of *Carasobarbus luteus* (Heckel, 1843) and *Capoeta trutta* (Heckel, 1843) (Cyprinidae) in the Tigris River, Turkey. Iranian Journal of Fisheries Sciences, 16(1):170-187.
Bılıcı, S., Kaya, A., Cıcek, T. and Dörtbudak, M. Y. 2016. Investigation of size and shape differences depend to sex, age and season on scales of smallmouth lotak (*Cyprinion kais*). Journal of Survey in Fisheries Sciences 3(1):37-45.
Bilici, S., Kaya, A., Cicek, T. and Unlu, E. 2017. Size and shape analysis of two close Cyprinidae species by geometric morphometric methods. Fresenius Environmental Bulletin, 26(1a):872-877.
Bilici, S., Ünlü, E., Çiçek, T. and Satici, Ö. 2016. The reproductive biology of *Carasobarbus luteus* and *Capoeta trutta* in the Tigris River, Turkey, Cybium, 40(2):147-153.
Bilio, M. and Niermann, U. 2004. Is the comb jelly really to blame for it all? *Mnemiopsis leidyi* and the ecological concerns about the Caspian Sea. Marine Ecology Progress Series, 269:173-183.
Bilke, E. H. 2004. Eine Bilanz: Saugbarben im therapeutischen Einsatz. Die Aquarien und Terrarien-Zeitschrift, 57(5):20-21.
Billard, R. (Ed.). 1995. Carp: biology and culture. Springer-Praxis Series in Aquaculture & Fisheries, Praxis Publishing, Chichester. xiii + 342 pp.
Billard, R. and Berni, P. 2004. Trends in cyprinid polyculture. Cybium, 28(3):255-261.
Billard, R. and Cosson, J. 2002. Le repeuplement de *Rutilus frisii kutum* dans la partie iranienne de la mer Caspienne. Bulletin de Liaison de la Société Française d'Ichtyologie, 22-23:4-5.
Bilqees, F. M., Ataur-Rahim, (M.) and Khatoon, N. 1995. History of Ichthyology in Pakistan. Biological Research Journal, Karachi, 2:77-141.
Binaii, M. 2016. Creation of cryopreservation bank of bony fish. Iranian Fisheries Science Research Institute, Tehran. 38 pp. In Farsi.
Binaii, M., Pourgholam, R., Baradaran Novairi, Sh., Ghiasi, M., Bahmani, M. and Ghaneii Tehrani, M. 2016. Evaluation of Caspian kutum (*Rutilus frisii kutum*) and Caspian salmon (*Salmo trutta caspius*) sperm quality before and after cryopreservation. Journal of Aquaculture Development, 10(3):57-67. In Farsi.
Biniaz, H., Vatandoust, S., Keshavarz, M., Ebrahimzadeh, E. S. and Joladeh, A. 2011. Effects of Alborz Dam in Babolrood River on some reproductive characteristics of *Squalius cephalus*. Journal of Animal Environment, 3(1):7-20. In Farsi.
Biokani, S., Amini, S. and Sarkhosh, J. 2011. The study of fishes in Gamasiab River of the Kermanshah Province and the effect of pollution on their dispersion. Journal of Animal Biology, 3(4):15-28. In Farsi.
Birecikligil, S. S., Eagderi, S., Jouladeh-Roudbar, A. and Çiçek, E. 2017. *Alburnoides recepi*, a junior synonym of *Alburnus caeruleus* (Teleostei: Cyprinidae). Zootaxa, 4277(1):129-136.
Birecikligil, S. S., Yücel, Ş. Y. and Çiçek, E. 2016. A taxonomic evaluation of *Alburnus sellal* Heckel, 1843 and *Alburnus adanensis* Battalgazi, 1944 based on morphological characters and mitochondrial DNA sequences. Pakistan Journal of Zoology, 48(2):465-

473
Biria, M., Javadzadeh-Poorshalkoohi, N. and Hosseini, S. A. 2014. Length-weight relationships *Carsobarbus* (*sic*) *luteus* (Heckel 1843) from Karoon River, Iran. Journal of Biodiversity and Environmental Sciences, 5(1):140-144.
Biria, M., Javadzadeh Pourshalkoohi, N., Hoseini, S. A. and Velayatzadeh, M. 2017. Investigation of some reproductive characteristic of *Carasobarbus luteus* in Karoon River. Iranian Scientific Fisheries Journal, 26(2):47-61. In Farsi.
Birks, J. S. 1984. The falaj: modern problems and some possible solutions. Waterlines, 2(4):28-31.
Biro, P., Al-Jafery, A. R. and Sadek, S. E. 1988. On stunted growth of Barbus luteus (Heckel) in river Diyala, Iraq. Journal of Biological Sciences Research, Baghdad, 19(1):129-147.
Bisheh, H., Ghorbani, R., Hosseini, S. A. and Molaei, M. 2017. The effects of physicochemical parameters on growth performance of *Rutilus rutilus caspicus* juvenile in ponds of Sijaval cultivation center. New Technologies in Aquaculture Development (Journal of Fisheries), 11(3):81-88. In Farsi.
Biswas, A. K. (Ed.). 1994. International Waters of the Middle East from Euphrates-Tigris to Nile. Oxford University Press, Bombay. xvii + 221 pp.
Biswas, S. P., Nasar, S. A. K. and Chatterjee, K. 1984. Inter- and intraspecific comparisons on some aspects of the reproductive biology of the two carps, *Labeo pangusia* (Ham.) and *Labeo dero* (Ham.). Archives de Biologie, Bruxelles, 95(1):11-27.
Bita, S., Abdollahzadeh Jamalabadi, M. Y. and Mesbah, M. 2015. Toxicity study of silver nanoparticles synthesized using seaweed *Sargassum angustifolium* in common carp, *Cyprinus carpio*. Journal of Chemical and Pharmaceutical Research, 7(11):91-98.
Bita, S., Mesbah, M., Shahryari, A. and Ghorbaanpour Najafabadi, M. 2016. Toxicity study of silver nanoparticles synthesized using seaweed *Sargassum angustifolium* in common carp, *Cyprinus carpio*. Journal of Veterinary Research, 71(2):219-227. In Farsi.
Bita, S., Mesbah, M., Shahryari, A. and Ghorbaanpour Najafabadi, M. 2019. Investigating the effect of silver nanoparticles synthesized using *Sargassum angustifolium* on the bacterial flora of common carp skin, *Cyprinus carpio*. Journal of Experimental Animal Biology, 8(1):11-18. In Farsi.
Biukani, S., Safarpour Amlashi, A. and Falahatkar, B. 2013. Fish fauna of Gamasiab River in Kermanshah Province. Journal of Fisheries Science and Technology, 2(1):1-12. In Farsi.
Björk, S. 2014. Limnological Methods for Environmental Rehabilitation: The Fine Art of Restoring Aquatic Ecosystems. E. Schweizerbart'sche Verlagsbuchhandlung (Nägele u. Obermiller), Stuttgart. 381 pp.
Blanford, W. T. 1876. Eastern Persia. An Account of the Journeys of the Persian Boundary Commission 1870-71-72. Vol. II. The Zoology and Geology. Macmillan and Co., London. viii + 516 pp.
Bleher, H. 2011. Biotopes of Iran: On the very brink. Practical Fishkeeping (www.practicalfishkeeping.co.uk/content.php?sid=3797, downloaded 12 April 2011), 8 pp.
Bloch, M. E. 1795-97. Ichthyologie, ou Histoire naturelle, générale et particulière des poissons. Avec des figures enluminées dessinées d'apres nature. Berlin. 12 parts.
Bobek, H. 1952. Beiträge zur Klima-Ökologischen Gliederung Irans. Erdkunde, 6(2/3):65-84.
Bobek, H. 1959. Features and formation of the Great Kawir and Masileh. Arid Zone Research Center, University of Tehran, 2:63 pp.

Bobek, H. 1963. Nature and implications of Quaternary climatic changes in Iran, pp. 403-413. In: Arid Zone Research - XX. Changes of Climate. Proceedings of the Rome Symposium organized by UNESCO and WHO, 1963.

Bodenheimer, F.-S. 1934. Contribution à l'étude de la zoogéographie des poissons du sud Paléarctique. Bulletin de la Société centrale d'Aquiculture, Clermont, 4-6:33-42.

Boeseman, M. 1947. Revision of the fishes collected by Burger and von Siebold in Japan. E. J. Brill, Leiden. viii + 242 pp., 5 pls.

Bogutskaya, H. (*sic*) G. 1991. Limits and morphological features of the cyprinid subfamily Leuciscinae (Cyprinidae). Journal of Ichthyology, 31(9):79-94.

Bogutskaya, N. G. 1986. Relationships between species of <u>Abramis</u>, <u>Blicca</u> and <u>Vimba</u> (Cyprinidae). Journal of Ichthyology, 26(5):1-9.

Bogutskaya, N. G. 1988. Morphological characters of some groups of genera of the subfamily Leuciscinae. Journal of Ichthyology, 28(3):26-34.

Bogutskaya, N. G. 1990. Morphological fundamentals in classification of the subfamily Leuciscinae (Leuciscinae, Cyprinidae). Communication 1. Journal of Ichthyology, 30(3):63-77.

Bogutskaya, N. G. 1994. A description of *Leuciscus lepidus* (HECKEL, 1843) with comments on *Leuciscus* and leuciscine - aspinine relationships (Pisces: Cyprinidae). Annalen des naturhistorischen Museums in Wien, 96B:599-620.

Bogutskaya, N. G. 1995. *Leuciscus kurui*, a new cyprinid fish from the upper Tigris (Dicle) system. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 92:149-154.

Bogutskaya, N. G. 1996. Contribution to the knowledge of leuciscine fishes of Asia Minor. Part 1. Morphology and taxonomic relationships of *Leuciscus borysthenicus* (Kessler, 1859), *L. smyrnaeus* Boulenger, 1896 and *Ladigesocypris ghigii* (Gianferrari, 1927). Publicaciones Especiales Instituto Español de Oceanografía, 21:25-44.

Bogutskaya, N. G. 1997. Contribution to the knowledge of leuciscine fishes of Asia Minor. Part 2. An annotated check-list of leuciscine fishes (Leuciscinae, Cyprinidae) of Turkey with descriptions of a new species and two new subspecies. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 94:161-186.

Bogutskaya, N. G. 2002. *Petroleuciscus*, a new genus for the *Leuciscus borysthenicus* species group (Teleostei: Cyprinidae). Zoosystematica Rossica, 11(1):235-237.

Bogutskaya, N. G. and Coad, B. W. 2009. A review of vertebral and fin-ray counts in the genus *Alburnoides* (Teleostei: Cyprinidae) with a description of six new species. Zoosystematica Rossica, 18(1):126-173.

Bogutskaya, N. G. and Iliadou, K. 2006. *Rutilus panosi*, a new roach from western Greece (Teleostei: Cyprinidae). Zoosystematica Rossica, 14(2):293-298.

Bogutskaya, N. G., Kijashko, P. V., Naseka, A. M. and Orlova, M. I. 2013. Identification keys for fish and invertebrates. Volume 1. Fish and molluscs. KMK Scientific Press Ltd., St. Petersburg-Moscow. 543 pp. In Russian.

Bogutskaya, N. G. and Komlev, A. M. 2001. Some new data to morphology of *Rhodeus sericeus* (Cyprinidae: Acheilognathinae) and a description of a new species, *Rhodeus colchicus*, from west Transcaucasia. Proceedings of the Zoological Institute, St. Petersburg, 287:81-97.

Bogutskaya, N. G. and Naseka, A.M. 2004. Katalog beschelyustnykh i ryb presnykh i solonovatykh vod Rossii c nomenklaturnymi i taksonomicheskimi kommentariyami

[Catalogue of Agnathans and Fishes of Fresh and Brackish Waters of Russia with comments on nomenclature and taxonomy]. Zoological Institute, Russian Academy of Sciences and KMK Scientific Press Ltd, Moscow. 389 pp., CD.

Bogutskaya, N. G., Naseka, A. M. and Komlev, A. M. 2001. Freshwater Fishes of Russia: preliminary results of the fauna revision. Proceedings of the Zoological Institute, Russian Academy of Sciences, Zoological Sessions (Annual Reports 2000), 289:39-50.

Bogutskaya, N. G., Naseka, A. M. and Tikhonov, P. A. 2008. A brief history of the study of fishes of the Caspian Sea and scientific results of the Caspian Expedition of 1904 headed by N. M. Knipovich. Aqua, International Journal of Ichthyology, 14(1):1-26.

Bogutskaya, N. G. and Zupančič, P. 2010. *Squalius janae*, a new species of fish from the Adriatic Sea basin in Slovenia (Actinopterygii: Cyprinidae). Zootaxa, 3536(1):53-68.

Bohlen, J., Šlechtová, V., Bogutskaya, N. and Freyhof, J. 2006. Across Siberia and over Europe: phylogenetic relationships of the freshwater fish genus *Rhodeus* in Europe and the phylogenetic position of *R. sericeus* from the River Amur. Molecular Phylogenetics and Evolution, 40(3):856-865.

Böhlke, E. B. 1984. Catalog of type specimens in the Ichthyological Collection of the Academy of Natural Sciences of Philadelphia. Special Publication of the Academy of Natural Sciences of Philadelphia, 14:viii + 246 pp.

Boltachev, A. R., Danilyuk, O. N., Pakhorukov, N. P. and Bondarev, V. A. 2006. Distribution and certain features of the morphology and biology of the stone moroko *Pseudorasbora parva* (Cypriniformes, Cyprinidae) in the waters of Crimea. Journal of Ichthyology, 46(1):58-63.

Bonine, M. E. 1980. The Urbanization of the Persian Gulf Nations, pp. 225-278. In: Cottrell, A. J. The Persian Gulf States. A General Survey. The Johns Hopkins University Press, Baltimore and London. xxxiv + 695 pp.

Bonine, M. E. 1982. From qanāt to kort: traditional irrigation terminology and practices in Central Iran. Iran, 20:145-159.

Booth, B. 1977. The making of Iran. Geographical Magazine, 49(4):243-249.

Borghei, M. and Vaziri, M. 1995. A study of Caspian Sea surface water level fluctuations. Iranian Journal of Science and Technology, Transactions B: Technology, 19(4):399.

Borji, H., Naghibi, A., Nasiri, M. R. and Ahmadi, A. 2012. Identification of *Dactylogyrus* spp. and other parasites of common carp in northeast of Iran. Journal of Parasitic Diseases, 36(2):234-238.

Borkenhagen, K. 2005. Systematik und Zoogeographie der "groβschuppigen Barben" des vorderen Orients. Diplomarbeit an der Mathematisch-Naturwissenschaftlichen Fakultät der Christian-Albrechts-Universität zu Kiel. 121 + x pp.

Borkenhagen, K. 2014. A new genus and species of cyprinid fish (Actinopterygii, Cyprinidae) from the Arabian Peninsula, and its phylogenetic and zoogeographic affinities. Environmental Biology of Fishes, 97(10):1179-1195.

Borkenhagen, K. 2017a. Molecular phylogeny of the tribe Torini Karaman, 1971 (Actinopterygii: Cypriniformes) from the Middle East and North Africa. Zootaxa, 4236(2):291-301.

Borkenhagen, K. 2017b. Taxonomy, phylogeny and zoogeography of the hexaploid Torini of the Middle East and North Africa. Dissertation zur Erlangung des Doktorgrades der Naturwissenschaften, Johann Wolfgang Goethe-Universität, Frankfurt am Main. xiii + 146 pp.

Borkenhagen, K., Esmaeili, H. R., Mohsenzadeh, S., Shahryari, F. and Gholamifard, A. 2011. The molecular systematics of the *Carasobarbus* species from Iran and adjacent areas, with comments on *Carasobarbus albus* (Heckel, 1843). Environmental Biology of Fishes, 91(3):327-335.

Borkenhagen, K. and Krupp, F. 2013. Taxonomic revision of the genus *Carasobarbus* Karaman, 1971 (Actinopterygii, Cyprinidae). ZooKeys, 339:1-53.

Boroumandi, E., Hashemzadeh Segherloo, I., Ashrafzadeh, M. and Rahimi, R. 2018. Phylogenetic comparison of *Alburnoides samiii* in Barkili and Chalkheh rivers (Caspian Sea basin) compared to other *Alburnoides*. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Borowicka, H. 1958. Report to the Government of Iran on the design of irrigation projects. Food and Agriculture Organization, Rome, Expanded Technical Assistance Program, Report No. 800:iv + 69 pp., 17 figs.

Bosak Kahkesh, F. 2016. Survey of different dietary energy and protein levels on the reproduction indices of Benni (*Barbus sharpeyi*) broodstock. Iranian Fisheries Science Research Institute, Tehran. 42 pp. In Farsi.

Bosak Kahkesh, F., Feshalami, M. Y., Amiri, F. and Nickpey, M. 2010. Effect of ovaprim, ovatide, HCG, LHRH-A2, LHRHA2+CPE and carp pituitary in benni (*Barbus sharpeyi*) artificial breeding. Global Veterinaria, 5(4):209-214.

Bosak Kahkesh, F., Yavari, V., Amiri, F., Makvandi, G. H. and Nikpay, M. 2012. Correlation between length-weight and age in *Barbus sharpeyi* and *Barbus grypus* broodstocks in artificial propagation. Iranian Scientific Fisheries Journal, 20(4):11-20. In Farsi.

Bosch, M., Kinunen, W., Bahrami, -. and Ahdami, A. 1970. Wetland survey and Mordab observations. Progress Report for July, 1970, Iran Game and Fish Department, Tehran, MS, 4 pp.

Boudaghpour, S. 2011. Arid season affecting Hamun Lake in south east Iran water, fishing and agriculture crisis. 2011 International Conference on Food Engineering and Biotechnology, International Proceedings of Chemical, Biological and Environmental Engineering, 9:193-197.

Boudaghpour, S. and Monfared, S. A. H. 2008. Environmental effects of irregular extracting of gravel from river beds. In: Proceedings of the 3rd IASME/WSEAS International Conference on Energy and Environment. World Scientific and Engineering Academy and Society (WSEAS), pp. 213-218.

Boustani, F., Hojati, M. and Ebrahimzadeh, S. 2012. Assessment of nickel concentration in surface and ground water of the Kowsar Dam basin. International Journal of Chemical and Biological Engineering, 6(3):208-211.

Boustani, F., Hojati, M. and Hashemi, M. 2011. Evaluation of water quality of the Beshar River. International Journal of Environmental, Ecological, Geological and Geophysical Engineering, 5(2):82-86.

Boyce, M. 1977. A Persian stronghold of Zoroastrianism based on the Ratanbai Katrak Lectures, 1975. Clarendon Press, Oxford. xv + 284 pp.

Bozorgnia, A. 2007. Study of parasites native and introduced species of fish in Caspian Sea. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 135 pp. In Farsi.

Bozorgnia, A., Omidzahir, S. H., Hoseini, S. M. and Darzi, S. H. 2016. Occurrence and histopathological effect of *Ligula intestinalis* on sea bream (*Abramis brama orientalis*).

Iranian Journal of Aquatic Animal Health, 2(2):34-43.
Bozorgnia, A., Shakoori, M., Shirzad, E. and Naghdi Moghadam, H. 2017. Study of parasite of Chaloos river fish with histopathology of parasitic contaminated tissue. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 139-143. In Farsi.
Bozorgnia, A., Youssefi, M. R., Barzegar, M., Hosseinifard, S. M. and Ebrahimpour, S. 2012. Biodiversity of parasites of fishes in Gheshlagh (Vahdat) Reservoir, Kurdistan Province, Iran. World Journal of Fish and Marine Sciences, 4(3):249-253.
Brandt, A. 1880. Von den armenischen Alpenseen. Zoologischer Anzeiger, 3(50):111-115.
Braun, C. 1974. Teheran, Marrakesch und Madrid. Ihre Wasserversorgung mit Hilfe von Qanaten. Eine stadtgeographische Konvergenz auf kulturhistorischer Grundlage. Bonner geographische Abhandlungen, 52:133 pp., 44 figs., 3 maps.
Brazier, T., Cherif, E., Martin, J-F., Gilles, A., Blanchet, S., Zhao, Y., Combe, M., Scott McCairns, R. J. and Gozlan, R. 2021. A tale of an invader: Reconstructing the genomic history of invasive topmouth gudgeon (*Pseudorasbora parva*) populations. Authorea, doi:10.22541/au.161417292.23392023/v1.
Breckle, S. W. 1983. Temperate deserts and semi-deserts of Afghanistan and Iran, pp. 271-319. In: West, N. E. (Ed.). Ecosystems of the World 5. Temperate Deserts and Semi-Deserts. Elsevier, Amsterdam. xi + 522 pp.
Brice, J. J. 1898. Manual of fish-culture based on the methods of the United States Commission of Fish and Fisheries. Report of the United States Commissioner of Fisheries 1897, Government Printing Office, Washington, D.C.
Brice, W. C. (Ed.). 1978. The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.
Briggs, J. C. 1987. Biogeography and plate tectonics. Developments in Palaeontology and Stratigraphy, Elsevier, Amsterdam, 10:x + 204 pp.
Brooks, C. E. P. 1949. Climate through the Ages: A study of the climatic factors and their variations. McGraw-Hill, New York. 395 pp.
Brooks, I. A. 1989. The physical geography, geomorphology and Late Quaternary history of the Mahidasht Project Area, Qara Su Basin, Central West Iran. Royal Ontario Museum, Toronto, Mahidasht Project, 1:xi + 48 pp., pls. I-V.
Broon, S., Javaheri Baboli, M. and Khodadadi, M. 2021. Determination and comparison of effective doses of clove powder, 2-phenoxyethanol and PI222 as anesthetic in *Mesopotamichthys sharpeyi*. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Brown, G. F. 1970. Eastern margin of the Red Sea and the coastal structures in Saudi Arabia. In: A discussion on the structure and evolution of the Red Sea, Gulf of Aden and Ethiopian rift junction. Philosophical Transactions of the Royal Society, A, 267:75-89, pl. 8.
Bruun, A. F. and Kaiser, E. W. 1944. Iranocypris typhlops n. g., n. sp., the first true cave fish from Asia. Danish Scientific Investigations in Iran, Copenhagen, 4:1-8.
Buckingham, J. S. 1829. Travels in Assyria, Media, and Persia, including a Journey from Bagdad by Mount Zagros, to Hamadan, the Ancient Ecbatana, Researches in Ispahan and the Ruins of Persepolis, and Journey from thence by Shiraz and Shapoor to the Sea-shore. Description of Bussorah, Bushire, Bahrein, Ormuz, and Muscat, Narrative of an Expedition against the Pirates of the Persian Gulf, with Illustrations of the Voyage of

Nearchus, and Passage by the Arabian Sea to Bombay. Henry Colburn, London. xvi + 545 pp., map.
Budge, E. A. W. 1920. By Nile and Tigris, a narrative of journeys in Egypt and Mesopotamia on behalf of the British Museum between the years 1886 and 1913. John Murray, London. 2 volumes.
Bulgakov, G. P. 1923. K ikhtiofaune Turkestana [To the ichthyofauna of Turkestan]. Trudy Turkmenskogo Nauchnogo Obshchestva, 1:225-238, 2 plates.
Bullock, S. 1970. Winter fishery survey. Division of Research and Development, Iran Game and Fish Department. MS.
Bullock, S. 1971. Neur Lake Survey (Lisar Protected Region) S-15-50. Iran Game and Fish Department, Tehran. MS.
Bullock, S. and Kinunen, W. 1970. Namrud and Delichay River Survey. Report, Division of Research and Development, Iran Game and Fish Department, Tehran. MS.
Bullock, S. and RaLonde, R. 1971a. Fall fishery survey Karaj Reservoir. Division of Research and Development, Iran Game and Fish Department, Tehran. MS.
Bullock, S. and RaLonde, R. 1971b. Fishery inventory survey coastal streams, 11-16 June 1971. Progress Report, Division of Research and Development, Iran Game and Fish Department, Tehran.7 pp., 1 fig.
Buringh, P. 1957. Living conditions in the lower Mesopotamian plain in ancient times. Sumer, 13(1 & 2):30-46, figs. 1-10.
Burton, A. 2016. …. and the golden fish of the Oxus. Frontiers in Ecology and the Environment, 14(9):516.
Butler, M. A. 1933. Irrigation in Persia by kanáts. Civil Engineering, 3(2):69-73.
Butt, J. A. 1995. On the riverine piscine culture in N.W.F.P. and adjoining areas of Pakistan. Proceedings of Seminar on Aquaculture Development in Pakistan held at Fisheries Research & Training Institute, Manawan, Lahore, Pakistan, October, 17-18, 1993:105-111.
Butt, J. A. and Khan, K. 1987. Food of freshwater fishes of North West Frontier Province, Pakistan. Proceedings of the Pakistan Congress of Zoology, 7:217-233.
Butz, K. 1978. Fischabgabe und Feldabgabe in Fischen und Vögeln an den Nanna-Tempel in Ur in altbabylonischer Zeit? Ein Versuch. Archiv für Orientforschung, 26:30-44.
Butzer, K. W. 1957. Late glacial and postglacial climatic variation in the Near East. Erdkunde, 11:21-35.
Butzer, K. W. 1958a. The Near East during the last glaciation: a palaeogeographical sketch. Geographical Journal, 124(3):367-369.
Butzer, K. W. 1958b. Quaternary stratigraphy and climate in the Near East. Bonner Geographische Abhandlungen, 24:1-157, 16 figs.
Butzer, K. W. 1961. Climatic change in arid regions since the Pliocene, pp. 31-56. In: Stamp, L. D. Arid Zone Research - XVII. A history of land use in arid regions. UNESCO, Paris. 388 pp.
Butzer, K. W. 1975. Patterns of environmental change in the Near East during Late Pleistocene and Early Holocene times, pp. 389-410. In: Wendorf, F. and Marks, A. E. (Eds.). Problems in Prehistory: North Africa and the Levant. Southern Methodist University Press, Dallas. 462 pp.
Butzer, K. W. 1978. The late prehistoric environmental history of the Near East, pp. 5-12. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the

Last Ice Age. Academic Press, London. xx + 384 pp.
Bybordi, M. 1974. Ghanats of Iran: drainage of sloping aquifer. Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, 100(IR3)(10785):245-253.
Bykhovski, B. E. 1949. Monogeneticheskie Sosal'shchiki Nekotorykh Ryb Irana, Sobrannye Akad. E. N. Pavlovskim [Monogenetic trematodes of some fishes in Iran, collected by Acad. E. N. Pavlovski]. Trudy Zoologicheskogo Instituta Akademii Nauk SSR, 8:870-878.

C

Caddy, J. F. 1984. Observations on prospects and constraints of development of Iranian fisheries. Food and Agriculture Organization, Rome, FI:TCP/IRA/2301 (Mf) Field Document 1:iv + 30 pp.
Çakır, N., Çiçek, E., Seçer, B. and Birecikligil, S. 2016. Age, growth and mortality of *Acanthobrama microlepis* (De Filippi, 1863) from Lake Çıldır, Turkey. Acta Biologica Turcica, 29(1):1-5.
Çalişkan, M., Yerli, S. V. and Canbolat, A. F. 1999. Çıldır Gölü (Ardahan) *Barbus plebejus* Heckel, 1843 Populasyonunun Büyüme Parametreleri [The growth parameters of *Barbus plebejus* Heckel, 1843 in Çıldır Lake-Ardahan]. Turkish Journal of Zoology, 23 (supplement 1):233-239.
Canbolat, A. F., Yerli, S. V. and Çalişkan, M. 1999. Çıldır Gölü'ndeki (Ardahan) *Capoeta capoeta capoeta* (GULDENSTANT (*sic*), 1773)'nın Büyüme Özelliklerinin İncelenmesi [The investigation of growth parameters of *Capoeta capoeta capoeta* (GULDENSTANT (*sic*), 1773) in Çıldır Lake (Ardahan, Kars)]. Turkish Journal of Zoology, 23 (supplement 1):225-232.
Carp, E. (Ed.). 1972. Proceedings of the International Conference on the Conservation of Wetlands and Waterfowl, Ramsar, Iran, 30 January- 3 February 1971. International Wildfowl Research Bureau, Slimbridge. 303 pp.
Carre, F. 1978. The Caspian Sea fisheries. Annals Georgia, 479:1-39.
Casal López, M. 2017. Phylogeny, phylogeography and evolution of *Luciobarbus* Heckel, 1843, in the western Mediterranean. Ph.D. Thesis, Universidad Complutense de Madrid. 232 pp.
Caspian Environmental Programme. 1998. Caspian Sea Environment National Report, Islamic Republic of Iran. Baku, Azerbaijan. pagination various.
Caspian Environmental Programme. 2000. Biodiversity of the Caspian Sea. Baku, Azerbaijan. 122 pp.
Caspian Environmental Programme. 2001a. Islamic Republic of Iran National Coastal Profile. Caspian Regional Thematic Center (CRTC) for Integrated Transboundary Coastal Area Management and Planning (ITCAMP), Tehran for the Caspian Environmental Programme, Baku, Azerbaijan. 219 pp.
Caspian Environmental Programme. 2001b. Habitat & biodiversity of Caspian Sea I. R. Iran. Baku, Azerbaijan. 70 pp.
Caspian Environmental Programme. 2001c. Emergency response data collection study, I. R. Iran. Caspian Regional Thematic Centre, Emergency Response (CRTC ER), Caspian Environmental Programme, Baku, Azerbaijan. 43 pp.
Caspian Environmental Programme. 2002a. Caspian Sea biodiversity strategy and action plan.

Final draft. Prepared by Fauna and Flora International for the Caspian Environmental Programme, Baku, Azerbaijan. 96 pp.

Caspian Environmental Programme. 2002b. Islamic Republic of Iran. National Caspian Action Plan (NCAP). Caspian Environmental Programme, Baku, Azerbaijan. 102 pp.

Catarino, M. M. R. S., Gomes, M. R. S., Ferreira, S. M. F. and Gonçalves, S. C. 2019. Optimization of feeding quantity and frequency to rear the cyprinid fish *Garra rufa* (Heckel, 1843). Aquaculture Research, 50(3):876-881

Chaharborji, M., Imanpour, M., Safari, R. and Jafar, A. 2019. Effect of spearmint essential oil on reducing stress during transportation of common carp (*Cyprinus carpio*). Journal of Animal Researches (Iranian Journal of Biology), 32(2):175-185. In Farsi.

Chaichi, A. 2010. The study of biological characteristic and population dynamic of Caspian vimba (*Vimba vimba persa*), in coastal waters of Caspian Sea (Mazandaran Province). Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 77 pp. In Farsi.

Chaichi, A., Vosoughi, G., Kaymaram, F., Jamili, S. and Fazli, H. 2011. Population dynamics of *Vimba vimba persa* in Iranian waters of the Caspian Sea. Cybium, 35(3):237-243.

Chaichi, A. R., Vosoughi, G. H., Kaymaram, F. Jamili, S. and Fazli, H. 2011. Reproduction characteristics of the *Vimba vimba persa* (Pallas, 1811), in coastal waters of the Caspian Sea. Iranian Journal of Fisheries Sciences, 10(4):585-595, IV.

Chakmehdouz Gasemi, F. and Behmanesh, S. H. 2015. Gene diversity and phylogeny relation of two species of *Rutilus* genus in southern part of Caspian Sea based on DNA sequencing of mitochondrial cytochrome b gene. Journal of Aquaculture Development, 9(3):19-28. In Farsi.

Chakmedouz Ghasemi, F., Behmanesh, Sh., Yarmohammadi, M. and Hasanzadeh Saber, M. 2014. The study of molecular and population diversity of *Rutilus frisii kutum* in Anzali Lagoon and Shirud River by using of molecular genetic method. Journal of Animal Biology, 7(1):21-30.

Chakmedouz Ghasemi, F., Pourkazemi, M., Zamini, A., Yarmohammadi, M., Baradaran Noveiri, S., Hasanzadeh Saber, M., Rezvani, S. and Azizzadeh, L. 2009. Genetic analysis of spring and autumn races of Caspian Sea kutum (*Rutilus frisii kutum*) using microsatellite markers. Iranian Journal of Animal Biosystematics, 5(1):1-8.

Chamanara, Y. and Farhoudi, A. 2013. Ontogenetic changes of pancreatic enzymes and fatty acids in egg and larvae of grass carp (*Ctenopharyngodon idella*). Journal of Fisheries (Iranian Journal of Natural Resources), 66(4):423-440. In Farsi.

Chandra, G., Bhattacharjee, I., Chatterjee, S. N. and Ghosh, A. 2008. Mosquito control by larvivorous fish. Indian Journal of Medical Research, 127(1):13-27.

Chang, C. H., Li, F., Shao, K. T., Lin, Y. S., Morosawa, T., Kim, S., Koo, H., Kim, W., Lee, J. S., He, S., Smith, C., Reichard, M., Miya, M., Sado, T., Uehara, K., Lavoué, S., Chen, W. J. and Mayden, R. L. 2014. Phylogenetic relationships of Acheilognathidae (Cypriniformes: Cyprinoidea) as revealed from evidence of both nuclear and mitochondrial gene sequence variation: evidence for necessary taxonomic revision in the family and the identification of cryptic species. Molecular Phylogenetics and Evolution, 81:182-194.

Chantre, E. 1882. Rapport sur une Mission scientifique dans l'Asie occidentale et spécialement dans les régions de l'Ararat et du Caucase. Archives des Missions scientifiques et litteraires, Série III(10):199-263, pl. I-XIV.

Chapman, R. W. 1971. Climatic changes and the evolution of landforms in the Eastern Province of Saudi Arabia. Bulletin of the Geological Society of America, 82(10):2713-2728.

Charamlambous, A. 2001. Industrial survey & urban wastewater assessment of pollution loads in I.R. Iran. TACIS (Technical Assistance to the Commonwealth of Independent States, European Union), Caspian Environment Programme Phase 2, Baku, Azerbaijan. ii + 45 pp.

Chardin, J. 1686. Journal du voyage du Chevalier Chardin en Perse et aux Indes orientales la Mer Noire & par la Colchide: Qui contient le voiage de Paris à Ispahan. Moses Pitt, London. (394 pp., Proquest, Eebo Editions, 2011).

Chari Aliabad, S., Saeedifard, F. and Akrami, R. 2019. Effects of different cooking methods on the heavy metals concentration, proximate composition and fatty acid composition of roach (*Rutilus rutilus caspicus*). Journal of Fisheries Science and Technology, 8(3):127-135. In Farsi.

Charkhab, S., Mohammadi, G. H., Khodadadi, M. and Chelemal Dezfulnejad, M. 2018. Sexing and gonad staging of *Tor grypus*. Journal of Aquaculture Development, 12(3):53-61. In Farsi.

Charyev, R. 1984. Some consequences of the introduction and acclimatization of grass carp, <u>Ctenopharyngodon</u> <u>idella</u> (Cyprinidae), in the Kara Kum Canal. Journal of Ichthyology, 24(3):1-8.

Chaudhary, A. E., Mirza, M. R. and Nazneen, S. 1991. A contribution to the anatomy of the alimentary canal and the food of some snow-carps (Pisces, Cyprinidae) of Pakistan. First Symposium on Fish and Fisheries of Pakistan, October, 19-20, 1991, Department of Zoology, Government College, Lahore, pp. 27-28 (abstract).

Chavoshian, S. A., Takeuchi, K. and Funada, S. 2005. An overview to transboundary and shared water resources management in Iran, technical challenges and solutions. Role of Water Sciences in Transboundary River Basin Management, Thailand, pp. 189-195.

Chavoshian, S. A., Takeuchi, K. and Magome, J. 2005. An overview of transboundary and shared water resources management in Iran: technical challenges and solutions. Program & Abstracts, 8th International Riversymposium 2005, 6-9 September, Brisbane, Australia (abstract).

Cheatsazan, H., Mahjoorazad, A., Rabani, V. and Zehzad, B. 2005. Identification of the fish fauna of Hajilar-Chai River (Northern Azerbaijan). International Congress of Biological Sciences, November 205, Karaj Azad University, Karaj (title).

Chelehmal Dezfoolnezhad, M., Bit Siah, K., Mesbah, M. and Asgary Sary, A. 2014. The effect of vitamin C on the immune system of *Barbus grypus*. Journal of Applied Biology, 27(1):23-34. In Farsi.

ChelemalDezfoul Nejad, M., Rohani Dezfouli, M., Javaheri Baboli, M., Ghaeni, M. and Mohit, L. 2014. Study the effects of microalgae haematococcus (*Haematococcus pluvialis*) powder in the diet on the chemical composition of common carp (*Cyprinus carpio*) fillet. Journal of Wetland Ecobiology, 6(1):83-89. In Farsi.

Chen, W-J., Lavoué, S. and Mayden, R. L. 2013. Evolutionary origin and early biogeography of otophysan fishes (Ostariophysi: Teleostei). Evolution, 67(8):2218-2239,

Chen, W-J. and Mayden, R. L. 2009. Molecular systematics of the Cyprinoidea (Teleostei: Cypriniformes), the world's largest clade of freshwater fishes: Further evidence from six nuclear genes. Molecular Phylogenetics and Evolution, 52(2):544-549.

Chen, W-J., Miya, M., Saitoh, K. and Mayden, R. L. 2008. Phylogenetic utility of two existing

and four novel nuclear gene loci in reconstructing Tree of Life of ray-finned fishes: The order Cypriniformes (Ostariophysi) as a case study. Gene, 423(2):125-134.

Chepalyga, A. L. 1984. Inland Sea Basins, pp. 229-247. In: Velichko, A. A. (Ed.) (Wright, H. E. and Barnosky, C. W. (Editors of the English-Language Edition)). Late Quaternary Environments of the Soviet Union. University of Minnesota Press, Minneapolis. xxvii + 327 pp.

Cheperli, B., Patimar, R., Bahalkeh, A. and Golzarianpour, K. 2014. A study on morphometric characteristics of common sawbelly (*Hemiculter leucisculus*) in five aquatic basin of Golestan province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Cheraghali, K. and Chamani, A. 2020. The concentration of lead, cadmium, zinc and copper in sediments of Ganduman wetland with geochemical indices. Journal of Wetland Ecobiology, 12(4):57-70. In Farsi.

Cheraghi, M., Khorasani, N. A., Jafari, M. and Mansouri Seyed, M. 2007. Analysis of pollution sources in Meymeh River. Iranian Journal of Natural Resources, 60(1):193-201. In Farsi.

Chikova, V. M. 1967. O sistematike golyavlya Leuciscus cephalus orientalis Nordm. i podusta Chondrostoma cyri Kessler Arpilichskogo vodokhranilishcha [On the systematics of golyavlya Leuciscus cephalus orientalis Nordm. and podusta Chondrostoma cyri Kessler in the Arpilichskogo reservoir]. Voprosy Ikhtiologii, 7, 1(42):18-22.

Chitsaz, H., Akrami, R. and Arab Arkadeh, M. 2016. Effect of dietary synbiotics on growth, immune response and body composition of Caspian roach (*Rutilus rutilus*). Iranian Journal of Fisheries Sciences, 15(1):170-182.

Chitsaz, H., Ziaei, R. and Akrami, R. 2012. Evaluation of sperm quality of common carp (*Cyprinus carpio*) by use of seminal plasma parameters in the southeast of Caspian Sea, Golestan Province. Journal of Fisheries, 6(3):69-80. In Farsi.

Chobineh, R., Esmaeili, H. R. and Zareian, H. 2012. Egg ultrastructure of *Capoeta mandica* Banarescu & Bianco, 1982 (Cypriniformes: Cyprinidae) from southern Iran using SEM. XVII National and V International Conference of Biology, Shahid Bahonar University, Kerman (poster).

Chobineh, R., Esmaeili, H. R., Zareian, H., Akhlagi, M. and Monsefi, M. 2012. Reproductive biology of the spotted barb *Capoeta mandica* Banarescu & Bianco, 1982 (Cypriniformes: Cyprinidae) from Mond River basin, southern Iran. XVII National and V International Conference of Biology, Shahid Bahonar University, Kerman (poster).

Chobkar, N., Emadi, H. and Negarestan, H. 2005. Effects of application trichlorfon toxin with different concentrations on growth of larvae and fry of Caspian kutum *Rutilus frisii kutum*. Journal of Environmental Science and Technology, 23:33-44. In Farsi.

Choobkar, N. 2007. The effects of the application of different concentrations of trichlorfon on survival and growth of larva and fry of Caspian kutum, *Rutilus frisii kutum*. Aquaculture Asia, 12(3):31-33.

Choobkar, N. 2009. Effects of *Zataria multiflora* Boiss essential oil and nisin on the growth of *Staphylococcus aureus* in light salted silver carp fillet (*Hypophthalmichthys molitrix*). Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 121 pp. In Farsi.

Choobkar, N., Aghajani, A. and Jokar, A. 2018. The effect of replacement of cow’s gelatin by *Cyprinus carpio* skin gelatin on some mineral contents and color parameters of functional pastill. Iranian Journal of Aquatic Animal Health, 4(2):40-54.

Choobkar, N., Akhondzadeh Basti, A., Sari, A. A., Gandomi, H. and Emami Rad, A. M. 2012. Effect of *Zataria multiflora* Boiss essential oil and nisin on shelf life in light salted fish fillet of silver carp (*Hypophthalmichthys molitrix*). Journal of Medicinal Plants, 11(supplement 9):205-215.

Choobkar, N., Akhoundzadeh Basti, A., Soltani, M., Sari, A. A., Emami Rad, A. M., Ghaeni, M. and Roomiani, L. 2012. Effects of different concentrations of sodium chloride on the growth of *Staphylococcus aureus* and *Listeria monocytogenes* in salted silver carp (*Hypophthalmichthys molitrix*) fish fillets. Journal of Food Hygiene, 1(4):1-8. In Farsi.

Choobkar, N., Soltani, M., Ebrahimzadeh Mousavi, H. A., Akhonzadeh Basti, A. and Matinfar, A. 2010. Effect of *Zataria multiflora* Boiss essential oil on the growth of *Staphylococcus aureus* in the light salted fillets of silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Fisheries Sciences, 9(3):352-359.

Chubian, F., Tizkar, B., Avakh, M. and Zahmatkesh, A. 2017. Changes of digestive enzyme activity in silver carp *Hypophthalmichthys molitrix* (Valenciennes, 1844) during ontogeny and larval stages. Journal of Applied Ichthyological Research, 5(1):43-54. In Farsi.

Ciccotto, P. J. and Page, L. M. 2016. Revised diagnosis of the genus *Gonorhynchus* McClelland (Teleostei: Cyprinidae: Labeonini) with redescription of *G. latius* (Hamilton) and revalidation of *G. wattanah* (Sykes). Zootaxa, 4127(3):471-492.

Cicek, E., Bilici, S. and Ünlu, E. 2016. Morphological differences among the *Garra rufa* populations (Cyprinidae) in Tigris River system of Southeast Turkey. Journal of Coastal Life Medicine, 4(7):521-526.

Çiçek, E., Birekcikligil, S. S. and Fricke, R. 2015. Freshwater fishes of Turkey: a revised and updated annotated checklist. Biharean Biologist, 9(2):141-157.

Çiçek, E., Eagderi, S., Seçer, B. and Sungur, S. 2021. *Capoeta kosswigi* Karaman, 1969 a junior synonym of *Capoeta damascina* (Valenciennes, 1842) (Teleostei: Cyprinidae). Turkish Journal of Zoology, 45(3):235-240.

Çiçek, E., Kaya, A. and Bilici, S. 2016. *Capoeta umbla* (Heckel, 1843)'nin Pullarinda Cinsiyet, Yaş ve Mevsime Bağli Varyasyonların Geometrik Morfometrik Yöntemlerle Incelenmesi (A survey on scale of *Capoeta umbla* (Heckel, 1843) by geometric morphometric methods depend on gender, age and season variations). Turkish Journal of Aquatic Sciences, 31(2):96-104.

Çiçek, E., Kaya, A., Bilkici, S. and Dörtbudak, M, Y. 2017. Discrimination of *Capoeta trutta* (Heckel, 1843) and *Capoeta umbla* (Heckel, 1843) from scales by geometric morphometric methods. Journal of Survey in Fisheries Sciences, 4(1):8-17.

Cicek, T., Kaya, A., Bilici, S. and Ünlu, E. 2016. Size and shape analysis of two close Cyprinidae species (*Garra variabilis-Garra rufa*) by geometric morphometric methods. Journal of Survey in Fisheries Sciences, 2(3):35-44.

Çiçek, E., Seçer, B., Öztürk, S. and Sungur, S. 2021. Age and growth of *Garra rufa* (Heckel, 1843) from Merzimen Stream, Euphrates River basin, Turkey. LIMNOFISH, Journal of Limnology and Freshwater Fisheries Research, 7(1):77-82.

Cicek, E., Sigirci, U., Birecikligil, S. and Saylar, Ö. 2016. Age, growth and mortality of Caspian spirlin, *Alburnoides eichwaldii* (De Filippi, 1863), from Aras River basin in Turkey. Iranian Journal of Fisheries Sciences, 15(3):1237-1245.

Çiçek, E., Sungur, S. and Fricke, R. 2020. Freshwater lampreys and fishes of Turkey: a revised and updated annotated checklist 2020. Zootaxa, 4809(2):241-270.

Çiçek, E. and Sungur Birekcikligil, S. 2016. Ichthyofauna of the Turkish parts of Kura-Aras River Basin. FishTaxa, 1(1):14-26.
Cıcek, T., Ünlu, E., Bılıcı, S. and Uysal, E. 2016. Morphological differences among the *Garra variabilis* populations (Cyprinidae) in Tigris River system of South East Turkey. Journal of Survey in Fisheries Sciences, 3(1):9-20.
Ciepielewski, W., Martyniak, A. and Szczerbowski, J. A. 2001. Ichthyofauna in the Dokan and Derbendikhan reservoirs. Archives of Polish Fisheries, 9(supplement 1):157-170.
Çiftci, Y., Gül Mutlu, A., Serkan Güçlü, S., Turan, D. and Küçük, F. 2020. Phylogeography of the genus *Chondrostoma* Agassiz, 1835 (Teleostei: Leuciscidae) in Anatolia, as inferred from mitochondrial DNA analysis. Zoology in the Middle East, 66(3):206-221.
CIRSPE (Italian Research and Study Centre for the Fishery). 2006a. Aquaculture Development in Sistan-Baluchestan 2005-2008. Technical Report, The Hamun Lake, Preliminary Analysis. CIRSPE (Italian Research and Study Centre for the Fishery), Rome. 70 pp. (www.iranitaly.net).
CIRSPE (Italian Research and Study Centre for the Fishery). 2006b. Aquaculture Development in Sistan-Baluchestan 2005-2008. Technical Report, Artificial reproduction of *Schizothorax zarudny* (*sic*). Methodological approach, Zabol/Zahedan March-June 2006.
CIRSPE (Italian Research and Study Centre for the Fishery), Rome. 48 pp., figs. (www.iranitaly.net).
Civil, M. 1961. The home of the fish. A new Sumerian literary composition. Iraq, 23(1-2):154-175.
Clark, R. B. 1986. Marine Pollution. Clarendon Press, Oxford. xiii + 215 pp.
Clay, C. H. 1977. Report on a mission to Iran to investigate the potential for fish production from man-made lakes. Food and Agriculture Organization, Rome. MS.
Clugston, J. P. and Shireman, J. V. 1987. Triploid grass carp for aquatic plant control. Fish and Wildlife Service, Washington, Fish and Wildlife Leaflet, 8:3 pp.
Coad, B. W. 1979. Poisonous and venomous freshwater fishes of Iran. Pahlavi Medical Journal, 9(4):388-407.
Coad, B. W. 1980a. A provisional, annotated check-list of the freshwater fishes of Iran. Journal of the Bombay Natural History Society, 76(1)(1979):86-105.
Coad, B. W. 1980b. Environmental change and its impact on the freshwater fishes of Iran. Biological Conservation, 19(1):51-80.
Coad, B. W. 1981c. Fishes of Afghanistan, an annotated checklist. Publications in Zoology, National Museums of Canada, 14:v + 26 pp.
Coad, B. W. 1981d. *Pseudophoxinus persidis*, a new cyprinid fish from Fars, southern Iran. Canadian Journal of Zoology, 59(11):2058-2063.
Coad, B. W. 1982a. Review of “Euphrates and Tigris, Mesopotamian Ecology and Destiny” by Julian Rozska (*sic*) with contributions by J. F. Talling, F. R. S. and Dr. K. E. Bainster (*sic*). Monographiae Biologicae, Volume 38, Dr. W. Junk by (*sic*) Publishers, The Hague, 1980. x + 122 pp., 36 figs., map.-U.S. $33.31. Matsya, Bulletin of the Indian Society of Ichthyologists, 7(1981):102-104.
Coad, B. W. 1982b. *Garra persica* Berg, 1913, a valid species of cyprinid fish from southern Iran. Cybium, 6(2):97-100.
Coad, B. W. 1982c. The identity of *Alburnus maculatus* Keyserling, a cyprinid fish from Esfahan Province, Iran. Japanese Journal of Ichthyology, 29(2):227-228.
Coad, B. W. 1982d. Studies on the systematics and zoogeography of the freshwater fishes of

Iran. Programme of the Fourth Congress of European Ichthyologists, 20.-24. 9. 1982, Hamburg, West Germany (abstract).
Coad, B. W. 1982e. A re-description and generic re-assignment of *Kosswigobarbus kosswigi* (Ladiges, 1960), a cyprinid fish from Turkey and Iran. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 79:263-265.
Coad, B. W. 1983. Review of "The Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka - A Handbook". By K. C. Jayaram. 1981. Zoological Survey of India, Calcutta. xxii + 475 pp., 208 figs., 13 plates (2 color). Rs 100.00 or $22.50. Copeia, 1983(1):280-282.
Coad, B. W. 1984. *Acanthobrama centisquama* Heckel and the validity of the genus *Mirogrex* Goren, Fishelson and Trewavas (Osteichthyes: Cyprinidae). Hydrobiologia, 109(3):275-278.
Coad, B. W. 1985. *Alburnus doriae* De Filippi, 1864 a synonym of *Leuciscus lepidus* (Heckel, 1843)(Osteichthyes: Cyprinidae). Matsya, 9-10(1983-1984):173-175.
Coad, B. W. 1987. Zoogeography of the Freshwater Fishes of Iran, pp. 213-228, 1 figure, 2 tables. In: Krupp, F., Schneider, W. and Kinzelbach, R. (Eds.). Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, Mainz, 1985. Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe A (Naturwissenschaften), 28, Dr. Ludwig Reichert Verlag, Wiesbaden, 338 pp.
Coad, B. W. 1991a. The qanat ichthyofauna of Iran. Research Results CONFERENCE des résultats de recherche 1991, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, March 21, 1991 / le 21 mars 1991. p. 27 (abstract).
Coad, B. W. 1991b. Fishes of the Tigris-Euphrates Basin: A Critical Checklist. Syllogeus, Ottawa, 68:1-49.
Coad, B. W. 1992a. Out of Africa? The large-scale barbs of Southwest Asia. Collections and Research CONFERENCE des collections et recherche 1992, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, February 18, 1992 / le 18 février 1992. p. 28 (abstract).
Coad, B. W. 1992b. Zoogeography of the fishes of Mesopotamia. Collections and Research CONFERENCE des collections et recherche 1992, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, February 18, 1992 / le 18 février 1992. p. 30 (abstract).
Coad, B. W. 1992c. Environmental change and its impact on the freshwater fishes of Iran, pp. 103-104. In: Trussell, D. (Ed.). The Social and Environmental Effects of Large Dams. Volume III. A Review of Literature. Wadebridge Ecological Centre, Camelford, U.K. xiv + 243 pp. (abstract of Coad (1980b)).
Coad, B. W. 1993. Expedition Field Techniques. Fishes. Expedition Advisory Centre, Royal Geographical Society, London. iv + 82 pp., 25 illustrations.
Coad, B. W. 1994a. Exotic and transplanted fishes in Southwest Asia. VIII Congress Societas Europaea Ichthyologorum, Oviedo, Spain, September 26 to October 2, 1994, p. 20 (abstract).
Coad, B. W. 1994b. Fishes from the qanats of Iran. VIII Congress Societas Europaea Ichthyologorum, Oviedo, Spain, September 26 to October 2, 1994, p. 75 (abstract).
Coad, B. W. 1994c. Criteria for assessing the conservation status of taxa. Science Forum Scientifique, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, November 21 Novembre 1994, p. 35 (abstract).
Coad, B. W. 1994d. Exotic and transplanted fishes in Southwest Asia. Science Forum

Scientifique, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, November 21 Novembre 1994, p. 36 (abstract).

Coad, B. W. 1995a. Freshwater Fishes of Iran. Acta Scientiarum Naturalium Academiae Scientiarum Bohemicae, Brno, 29(1):1-64.

Coad, B. W. 1995b. Expedition Field Techniques: Fishes. Expedition Advisory Centre, Royal Geographical Society, London. 2nd Edition. v + 97 pp., 27 illustrations.

Coad, B. W. 1996a. Systematics of the shah mahi, *Chalcalburnus chalcoides* (Güldenstädt, 1772), in the southern Caspian Sea basin (Actinopterygii: Cyprinidae). Zoology in the Middle East, 12(1):65-70.

Coad, B. W. 1996b. Threatened fishes of the world: *Iranocypris typhlops* Bruun and Kaiser, 1944 (Cyprinidae). Environmental Biology of Fishes, 46(4):374.

Coad, B. W. 1996c. Freshwater fishes of Iranian and Pakistani Baluchistan. Second Symposium on Fish and Fisheries of Pakistan, November, 25, 26, 1996, Department of Zoology, Government College, Lahore, pp. 25-26 (abstract).

Coad, B. W. 1996d. Zoogeography of the fishes of the Tigris-Euphrates Basin. Zoology in the Middle East, 13(1):51-70.

Coad, B. W. 1996e. Exotic fish species in the Tigris-Euphrates basin. Zoology in the Middle East, 13(1):71-83.

Coad, B. W. 1996f. Fishes from the *qanats* of Iran. Publicaciones Especiales Instituto Español de Oceanografía, 21:63-79.

Coad, B. W. 1996g. Exotic and transplanted fishes in Southwest Asia. Publicaciones Especiales Instituto Español de Oceanografía, 21:81-106.

Coad, B. W. 1997a. Systematic biodiversity in the freshwater fishes of Iran. Ninth International Congress of European Ichthyologists (CEI9) “Fish Biodiversity”. Italy 1997 (Napoli-Trieste). Book of Abstracts, p. 25.

Coad, B. W. 1997b. Freshwater fishes of Iranian and Pakistani Baluchistan. Biologia, Lahore, 42(1 & 2)(1996):1-18.

Coad, B. W. 1997c. Systematic biodiversity in the freshwater fishes of Iran. Science FORUM scientifique, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, November 20 novembre, 1997, p. 27 (abstract).

Coad, B. W. 1998a. Description of *Barbus sublimus* Coad and Najafpour, 1997, 2 pp., 2 figures. In: Berrebi, P. (Ed.). Atlas *Barbus* on the Internet, Université Montpellier, France (http://162.38.181.13/webbarbus/).

Coad, B. W. 1998b. Description of *Barbus grypus* Heckel, 1843, 2 pp., 2 figures. In: Berrebi, P. (Ed.). Atlas *Barbus* on the Internet, Université Montpellier, France (http://162.38.181.13/webbarbus/).

Coad, B. W. 1998c. Systematic biodiversity in the freshwater fishes of Iran. Italian Journal of Zoology, 65 (Supplement):101-108. (Proceedings of the Ninth Congress of European Ichthyologists (CEI-9) “Fish Biodiversity” organised in Naples at the University Federico II and held in Trieste - Italy, 24-30 August 1997).

Coad, B. W. 1998d. Expedition Field Techniques: Fishes. Expedition Advisory Centre, Royal Geographical Society, London. 2nd Revised Edition. v + 97 pp., 27 illustrations. ISBN 0-907649-71-8.

Coad, B. W. 1999a. Researchs and scientists. Brian W. Coad. Iran Nature and Wildlife Magazine, Farvadin 1378(3):2 pp., 2 figures. In Farsi and English.

Coad, B. W. 1999b. (Fish). i. Freshwater fishes, pp. 655-669. In: Yarshater, E. (Ed.).

Encyclopædia Iranica. Bibliotheca Persica Press, New York. Volume IX, Fascicle 6. Festivals VIII-Fish.
Coad, B. W. 2000. Criteria for assessing the conservation status of taxa (as applied to Iranian freshwater fishes). Biologia, Bratislava, 55(5):539-557.
Coad, B. W. 2003. Freshwater fishes, 15 pp., 20 figures, 2 tables. In: Yarshater E. (Ed.). Encyclopædia Iranica (Daneshnameh-ye Iranika). Volume IX, Fascicule 6. Festivals VIII - Fish. Bibliotheca Persica Press, New York (online version of Coad (1999b) at www.iranica.com/articles/v9f6/v9f641a.html, downloaded 30 July 2003).
Coad, B. W. 2006. Endemicity in the freshwater fishes of Iran. Iranian Journal of Animal Biosystematics, 1(1)(2005):1-13.
Coad, B. W. 2007. Review of "The Complete Fauna of Iran" by Eskandar Firouz. 2005. I. B. Tauris. London, New York. xiv + 322 pp. US$90.00. Canadian Field-Naturalist, 120(1)(2006):114-116.
Coad, B. W. 2008. Fishes of Tehran Province and adjacent areas. Shabpareh Publications, Tehran. 244 pp., 38 figures. ISBN 978-600-5038-02-6.
Coad, B. W. 2009a. Threatened fishes of the world: *Luciobarbus subquincunciatus* (Günther, 1868) (Cyprinidae). Environmental Biology of Fishes, 86(2):323.
Coad, B. W. 2009b. *Alburnus zagrosensis* n. sp., a new species of fish from the Zagros Mountains of Iran (Actinopterygii: Cyprinidae). Zoology in the Middle East, 48(1):63-70.
Coad, B. W. 2010. Freshwater Fishes of Iraq. Pensoft Publishers, Sofia-Moscow. 294 pp.,16 colour plates. ISBN 978-954-642-530-0, Pensoft Series Faunistica, 93, ISSN 1312-0174.
Coad, B. W. 2014. Fishes of Afghanistan. Pensoft Publishers, Sofia-Moscow. 393 pp., 16 colour plates.
Coad, B. W. 2015a. Review of the freshwater catfishes of Iran (Order Siluriformes). Iranian Journal of Ichthyology, 1(4)(2014):218-257.
Coad, B. W. 2015b. The fishes of Saʿdī's Tomb. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015 (poster).
Coad, B. W. 2015c. Native fish biodiversity in Afghanistan. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015 (poster).
Coad, B. W. 2015d. The fishes of Saʿdī's Tomb. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 1-7.
Coad, B. W. 2015e. Native fish biodiversity in Afghanistan. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 8.
Coad, B. W. 2015f. Native fish biodiversity in Afghanistan. Iranian Journal of Ichthyology, 2(4):227-234.
Coad, B. W. 2018a. Freshwater Fishes of Iraq. Alghadeer Co. Ltd., Basra, Iraq (Marine Science Centre, Basrah University and Ministry of Environment, Iraq). 337 pp. In Arabic, translated by Nader A. Salman.
Coad, B. W. 2018b. Review of the danionids of Iran (Family Danionidae). International Journal of Aquatic Biology, 6(4):179-188.
Coad, B. W. 2018c. Review of the bitterlings of Iran (Family Acheilognathidae). Iranian Journal of Ichthyology, 5(4):257-267.
Coad, B. 2019a. A possible new species almost found - but lost/Une espèce probablement nouvelle qui se perd avant d'être réellement découverte. Canadian Museum of Nature blog posted on 20 February 2019.

Coad, B. W. 2019b. Review of the gobionids of Iran (Family Gobionidae). Iranian Journal of Ichthyology, 6(1):1-20.
Coad, B. W. 2019c. Review of the tenches of Iran (Family Tincidae). Iranian Journal of Ichthyology, 6(2):82-91.
Coad, B. W. 2020. Review of the East Asian minnows of Iran (Family Xenocyprididae). Iranian Journal of Ichthyology, 7(1):1-67.
Coad, B. W. 2021. The discovered subterranean habitats of cave fishes in the Zagros Mountains, Iran, in press. In: Taheri, K., Groves, C., Mohammadi, Z., Biglari, F., Sharifi, A. and Raftar, R. K. (Eds.). Caves and Karst Research in Iran. Springer Nature, Series: Cave and Karst Systems of the World, On the Occasion of the International Year of Caves and Karst 2021 https://iyck2021.org/.
Coad, B. W. (Continuing). Bibliography on the Freshwater Fishes of Iran. http://gause.biology.ualberta.ca/Keivany/irbiblcoad.html. First posted 10 September 1996. Page originally maintained by Yazdan Keivany at the University of Alberta, Edmonton and now replaced by the website at www.briancoad.com, maintained by Brian W. Coad and Nicholas P. Coad, Ottawa, Ontario, Canada.
Coad, B. W. (Continuing). Freshwater Fishes of Iran. First posted 26 February 2002 at www.briancoad.com, maintained by Brian W. Coad and Nicholas P. Coad, Ottawa, Ontario, Canada and now superseded in part by various published papers reviewing fish families in Iran.
Coad, B. W. (Continuing). Freshwater Fishes of Iraq. Bibliography and Checklist. First posted 28 September 2005 at www.briancoad.com, maintained by Brian W. Coad and Nicholas P. Coad, Ottawa, Ontario, Canada.
Coad, B. W. and Abdoli, A. 1993a. Exotic fish species in the fresh waters of Iran. Science Forum scientifique, Canadian Museum of Nature / Musée canadien de la nature, Ottawa, November 17 novembre 1993. p. 40 (abstract).
Coad, B. W. and Abdoli, A. 1993b. Exotic fish species in the fresh waters of Iran. Zoology in the Middle East, 9(1):65-80.
Coad, B. W. and Abdoli, A. 1996. Biodiversity of Iranian freshwater fishes. Abzeeyan, Tehran, 7(1):4-10, IV. In Farsi, English abstract.
Coad, B. W. and Abdoli, A. 2000. Systematics of an isolated population of tooth-carp from northern Iran (Actinopterygii: Cyprinodontidae). Zoology in the Middle East, 21(1):87-102.
Coad, B. W. and Al-Hassan, L. A. J. 1989. A Bibliography of the Fishes of the Tigris-Euphrates Basin / Bibliographie der Fische des Euphrat-Tigris-Beckens. Max Kasparek Verlag, Heidelberg. 56 pp. ISBN 3-925064-05-2. DM 19.80. (dated 1988).
Coad, B. W., Atz, J. W. and Keivany, Y. 2000. Fish imagery in art 82: Jonah and the fish. Environmental Biology of Fishes, 57(1):9.
Coad, B. W. and Bogutskaya, N. G. 2009. *Alburnoides qanati*, a new species of cyprinid fish from southern Iran (Actinopterygii, Cyprinidae). ZooKeys, 13:67-77.
Coad, B. W. and Bogutskaya, N. G. 2010. *Petroleuciscus esfahani*, a new species of fish from central Iran (Actinopterygii: Cyprinidae). Zootaxa, 2534(1):37-47.
Coad, B. W. and Bogutskaya, N. G. 2012. A new species of riffle minnow, *Alburnoides holciki*, from the Hari River basin in Afghanistan and Iran (Actinopterygii: Cyprinidae). Zootaxa, 3453(1):43-55.
Coad, B. W. and Esmaeili, H. R. 2009a. Desert Fishes of Iran. Desert Fishes Council 41st

Annual Meeting, Furnace Creek Ranch, Death Valley National Park, California, 19 to 22 November, 2009 (abstract).
Coad, B. W. and Esmaeili, H. R. 2009b. Desert Fishes of Iran. Videotape of Coad and Esmaeili (2009a) presented at the Native Aquatic Species Restoration Webinar CSP3901, National Conservation Training Center, Shepherdstown, West Virginia, 10 December 2009.
Coad, B. W. and Holčík, J. 1999. Systematics of the cyprinid fish *Chalcalburnus atropatenae* (Berg, 1925) from the Lake Orumiyeh basin in northwest Iran. Biologia, Bratislava, 54(2):179-186.
Coad, B. W. and Hussain, N. A. 2007. First record of the exotic species *Hemiculter leucisculus* (Actinopterygii: Cyprinidae) in Iraq. Zoology in the Middle East, 40(1):107-109.
Coad, B. W. and Keivany, Y. 2002. Reviews of “Atlas of Iranian Fishes: Gilan Inland Waters. K. Abbasi, A. Valipour, D. Talebi Haghighi, A. Sarpanah, and Sh. Nezami. 1999. Gilan Fisheries Research Centre, Rasht. vi + 113 p. 35,000 Rls ($4.38) (paperback). The Inland Water Fishes of Iran. A. Abdoli. 2000. Iranian Museum of Nature and Wildlife, Tehran. ISBN: 964-6902-01-4. 378 p. 75,000 Rls ($9.38) (hardbound). A Guide to the Fauna of Iran. E. Firouz. 2000. Iran University Press (University Publication Centre), Tehran. ISBN: 964-01-0956-8. vi + 491 p. 45,000 Rls ($5.63) (hardbound). Freshwater Fishes of Iran. H. Mohammadian. 1999. Sepehr Publications Centre, Tehran. ISBN: 946-6123-18.X. vii + 178 p. 12,000 Rls ($1.50) (paperback)”. Copeia, 2002(4):1164-1166.
Coad, B. W. and Keyzer-de Ville, N. 2004. On the systematics and distribution of the snow trout, *Schizothorax pelzami* Kessler, 1870, in Iran (Actinopterygii: Cyprinidae). Zoology in the Middle East, 32(1):57-62.
Coad, B. W. and Keyzer-de Ville, N. 2005. On the validity of the species in the snow-trout genus *Schizocypris* Regan, 1914 (Cyprinidae: Actinopterygii). Zoology in the Middle East, 35(1):35-42.
Coad, B. W. and Krupp, F. 1983. Redescription of *Barilius mesopotamicus* Berg, 1932 a poorly known cyprinid fish from the Tigris-Euphrates basin. Cybium, 7(1):47-56.
Coad, B. W. and Krupp, F. 1994. *Capoeta aculeata* (Valenciennes in Cuv. & Val., 1844), a valid species of cyprinid fish from Iran (Teleostei: Cyprinidae). Zoology in the Middle East, 10(1):63-72.
Coad, B. W. and Kuru, M. 1986. Bibliographie der Fische der Türkei/A Bibliography of the Fishes of Turkey, pp. 15-77. In: Kasparek, M. (Ed.). Zoologische Bibliographie der Türkei. Zoological Bibliography of Turkey. Pisces, Amphibia, Reptilia. Max Kasparek Verlag, Heidelberg. 118 pp. ISBN 3-925064-01-X.
Coad, B. W. and McAllister, D. E. (Continuing). Dictionary of Ichthyology. First posted 4 September 2002 at www.briancoad.com, maintained by Brian W. Coad and Nicholas P. Coad, Pure Throttle Technologies Inc., Ottawa, Ontario.
Coad, B. W. and Najafpour, N. 1997. *Barbus sublimus*, a new species of cyprinid fish from Khuzestan Province, Iran. Ichthyological Exploration of Freshwaters, 7(3):273-278.
Coad, B. W. and Vilenkin, B. Ya. 2004. Co-occurrence and zoogeography of the freshwater fishes of Iran. Zoology in the Middle East, 31(1):53-61.
Coad, B. W. with Waszczuk, H. and Labignan, I. 1995. Encyclopedia of Canadian Fishes. Canadian Museum of Nature, Ottawa and Canadian Sportfishing Productions, Waterdown. viii + 928 pp.
Çoban, M. Z., Gündüz, F., Demirol, F., Örnekçi, G. N., Yüce, S., Karakaya, G., Türkgülü, I. and Alp, A. 2013. Population dynamics and stock assessment of *Capoeta umbla* (Heckel,

1843) in Lake Hazar, Elaziğ, Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 13(2):221-231.

Çoban, M. Z., Gündüz, F., Türkgülü, I., Örnekçi, N. G., Yüce, S., Demirol, F. and Alp, A. 2013. Reproductive properties of *Capoeta umbla* (Heckel, 1843) living in Hazar Lake (Elaziğ, Turkey). International Journal of Agricultural and Food Research, 2(2):38-47.

Çoban, M. Z., Türkgülü, İ., Yüksel, F., Celayir, Y., Yüce, S., Eroğlu, M., Yıldız, N. and Şen, D. 2012. Some biological characteristics of *Luciobarbus esocinus* Heckel, 1843 living in Keban Reservoir. Turkish Journal of Fisheries and Aquatic Sciences, 12(1):73-80.

COFREPECHE. 1997. Iranian Fisheries Sector Study. Parts 1-4. Report prepared for Shilat (Fisheries Department), Jihad-e Sazandagi, Islamic Republic of Iran.

Çolak, A. 1983. Tatlısu kefali, *Leuciscus lepidus* (Heckel, 1843)'un boy-yaş ilişri üzerine araştirmalar [Research on relationships between length and age of *Leuciscus lepidus* (Heckel, 1843)]. Istanbul Üniversitesi Veteriner Fakültesi Dergisi, 9(1):21-29.

Collares-Pereira, M. J. 1994. The karyology of barbins and the possible plesiomorphic condition of polyploïdy in Cyprinidae. Bulletin français de la pêche et de la pisciculture, 334:191-199.

Conrad, G. and Conrad, J. 1970. L'évolution quaternaire de la dépression du Lout (Iran oriental). Comptes Rendus de l'Académie des Sciences, Paris, 270, série D, 9:1672-1674. Conservation of Iranian Wetlands Project. 2011. The Impacts of Drought on the Outcomes of the IRI/UNDP/GEF Conservation of Iranian Wetlands Project. A report to DOE and UNDP, July 2011. 42 pp.

Conway, K. W., Hirt, M. V., Yang, L., Mayden, R. L. and Simons, A. M. 2010. Cypriniformes: systematics and paleontology, pp. 295-316. In: Nelson, J. S., Schultze, H.-P. and Wilson, M. V. H. (Eds.). Origin and Phylogenetic Interrelationships of Teleosts. Verlag Dr. Freidrich Pfeil, München. 480 pp.

Cook, J. M. 1985. The rise of the Achaemenids and establishment of their empire, pp. 200-291. In: Gershevitch, I. (Ed.). The Cambridge History of Iran. Volume 2. The Median and Achaemenian Periods. Cambridge University Press, Cambridge. 946 pp.

Cornwallis, L. 1968a. A report on the wetlands and waterfowl of Fars, S.W. Iran. MS Report, Department of Biology, Pahlavi University, Shiraz, Iran. 32 pp., 7 maps.

Cornwallis, L. 1968b. Some notes on the wetlands of the Niriz basin in S. W. Iran. Proceedings of a Technical Meeting on Wetland Conservation, Ankara-Bursa-Istanbul, 9 to 16 October 1967, International Union for Conservation of Nature and Natural Resources Publication, new series, 12:152-160.

Cornwallis, L. 1976. The impact of the Mahabad Project on Lake Rezaiyeh and its southern satellite wetlands together with proposals for the conservation of the latter. Division of Nature Conservation, Department of the Environment, Tehran, Report Number W-1-35-2, 11 pp.

Corse, E., Tarkan, A. S., Emiroğlu, Ö., Imsiridou, A., Minos, G., Lorenzoni, M., Vilizzi, L. and Aboim, M. A. 2015. Covariation of trophic and habitat-related traits in chondrostoms (Cyprinidae): implications for repeated and diversifying evolutionary processes. Journal of Zoology, 295(4):294-305.

Costantini, L. and Tosi, M. 1978. The environment of southern Sistan in the Third Millennium B.C., and its exploitation by the proto-urban Hilmand civilization, pp. 165-183. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.

Courtenay, W. R. and Stauffer, J. R. (Eds.). 1984. Distribution, Biology, and Management of Exotic Fishes. Johns Hopkins University Press, Baltimore. xiv + 430 pp.

Cressey, G. B. 1958a. The Shatt al-Arab Basin. Middle East Journal, 12(4):448-460.

Cressey, G. B. 1958b. Qanats, karez, and foggaras. Geographical Review, 48(1):27-44.

Crockett, J. 1996. Project formulation for fisheries training and extension. Islamic Republic of Iran, Fisheries Training Service, Food and Agriculture Organization, Rome, Technical Cooperation Programme, Rome. 25 pp.

Cudmore, B. and Mandrak, N. E. 2004. Biological synopsis of grass carp (*Ctenopharyngodon idella*). Canadian Manuscript Report of Fisheries and Aquatic Sciences, 2705:v + 44 pp.

Cudmore, B. and Mandrak, N. E. 2011. Biological synopsis of tench (*Tinca tinca*). Canadian Manuscript Report of Fisheries and Aquatic Sciences, 2948:v + 20 pp.

Currie, D. 2006. Afghanistan Alternative Livelihood Project - Southern Region. Fish farm feasibility study Helmand and Kandahar Provinces. Chemonics International for United States Agency for International Development (USAID). ii + 33 pp.

Curzon, G. N. 1892. Persia and the Persian Question. Longmans, Green and Co., London. 2 vols.

Cuvier, G. and Valenciennes, A. 1828-1849. Histoire naturelle des poissons. 22 volumes. Paris. (Reprint A. Asher & Co., Amsterdam).

Cyrus, A., Gholam Reza, E. G., Elham, J., Reza, M. S., Afsane, T., Rahim, O. and Soroor, E. 2009. Genetic survey on some important Barbus species in south-west of Iran. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 66 (abstract).

D

Dad, S., Ghorbani, R., Darijani, A., Yaghghi, S. and Yahyaee, M. 2013. A survey of profitability and performance of fish beach seine Cooperative Companies in Golestan Province in 2009-2010. Journal of Utilization and Cultivation of Aquatics, 2(1):27-40. In Farsi.

Dad, S., Ghorbani, R., Darijani, A., Yulghi, S. and Yahyaee, M. 2016. Technical efficiency and factors effecting using DEA approach (case study: beach seine cooperative companies in Golestan Province. Journal of Fisheries (Iranian Journal of Natural Resources), 68(4):495-504. In Farsi.

Dad, S., Jafarian, H., Farabi, S. M. V., Patymar, R., Roohi, A. and Harsij, M. 2019. The effects of fish culture in floating cages on the seabed sediments and macrobenthos community in the southern Caspian Sea, Kelarabad. Journal of Aquaculture Development, 13(1):61-77. In Farsi.

Dadai Ghandi, A., Abbasi, K., Yousefzad, E., Sabkara, J., Makaremi, M., Madadi, F. and Bagheri, S. 2017. Structure of aquatic organisms in the Ghalehchai Lake, Eastern Azerbaijan. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Dadar, M., Adel, M., Nasrollahzadeh Saravi, H. and Dadar, M. 2016. A comparative study of trace metals in male and female Caspian kutum (*Rutilus frisii kutum*) from the southern basin of Caspian Sea. Environmental Science and Pollution Research, 23(24):24540-24546.

Dadashi, F., Ouraji, H., Keramat, A. and Jani Khalili, K. 2017. The effects of tomato pomace with enzyme on growth, body composition and digestibility of common carp (*Cyprinus carpio* L.). Journal of Fisheries (Iranian Journal of Natural Resources), 70(2):170-178. In Farsi.

Dadashi, N., Bahram, S. and Javadian, R. 2014. Biodiversity, abundance, and distribution of fishes in Gongir River, Ilam, Iran. http://ssrn.com/abstract=2696449.

Dadashpour Ahangari, V., Rahmani, H., Vatandust, S., Gorjian Arabi, M. H. and Rouhi, M. 2010. Investigation of morphometric and meristic characteristics of *Squalius cephalus* populations in Gamasiab and Talar River. Journal of Aquatic Sciences, 1(3):47-59. In Farsi.

Dadaye Ghandi, A., Khodaparast, S. K. and Esmaeili Sari, A. 2005. Assessing water contamination with anionic surfactants in Anzali Lagoon. Iranian Scientific Fisheries Journal, 14(3):60-68. In Farsi.

Dadelahi Sohrab A., Nabavi S. M. B. and Khirvar, N. 2009. The relationship between biometric characters of *Barbus grypus* with heavy metals levels in tissues (muscle and gills) from Arvand River, Iran. Iranian Scientific Fisheries Journal, 17(4):27-34. In Farsi.

Dadgar, Sh., Chehrzad, F. and Razimi, K. 2014. Study of qualitative effects of rainbow trout farms on Shahroud River using Hilsenhoff macrobenthic rapid bioassessment index. Journal of Animal Environment, 6(3):143-152. In Farsi.

Dadgar, Sh. and Owfi, F. 2015. The effect of *Mnemiopsis leidyi* on the Caspian Sea ecosystem. Middle East Aquaculture Forum, Dubai International Convention and Exhibition Center, Dubai, United Arab Emirates, 5-6 April 2015 (abstract).

Dadgar, Sh., Salehi, H., Hajimirrahimi, S. D. and Teimoori, M. 2015. Measuring of per capita fish consumption and assessing barriers and development strategies for consumption in Markazi Province. Iranian Scientific Fisheries Journal, 23(4):17-29, 18. In Farsi.

Dadgar, Sh., Seidgar, M., Nekuiefard, A., Valipour, A. R., Sharifian, M. and Hafezieh, M. 2019. Oral administration of garlic powder (*Allium sativum*) on growth performance and survival rate of *Carassius auratus* fingerlings. Iranian Journal of Fisheries Sciences, 18(1):71-82.

Dadikyan, M. G. 1970. A new subspecies of white bream [Blicca bjoerkna derjavini, subsp. N.] from the Sevdzhur River. Journal of Ichthyology, 10(4):550-552.

Dadikyan, M. G. 1972. A new subspecies of the European riffle minnow Alburnoides bipunctatus armeniensis subsp. nov. Journal of Ichthyology, 12(3):519-522.

Dadikyan, M. G. 1973. Variability of the Armenian riffle minnow (Alburnoides bipunctatus eichwaldi (Filippi)) in relation to the altitude at which it occurs. Journal of Ichthyology, 13(1):68-78.

Dadikyan, M. G. 1986. Ryby Armenii [Fishes of Armenia]. Izdatel'stvo Akademiya Nauk Armyanskoi SSR, Yerevan. 245 pp.

Dadjouy, S. 2012. Restoration ecology of Anzali Wetland invaded by Azola (*sic*). IUCN World Conservation Congress, 6-15 September, Jeju, Korea. 4 pp.

Dadolahi-Sohrab, A. and Arjomand, F. 2011. Water quality index of Karoon River as indicator of Khorramshahr Soap Factory sewage outlet. Journal of Oceanography, 1(4):21-27. In Farsi.

Dadras, H., Zahmatkesh, M., Khara, H., Baradaran Noveiri, S. and Nezami, S. 2011. Effect of male broodfish age on efficiency of artificial fertilization in bighead carp (*Aristichthys nobilis*). Journal of Animal Environment, 3(2):59. In Farsi.

Dadras, H., Zahmatkesh, M., Nezami, S., Khara, H. and Baradaran Noveiri, S. 2011a. Effect of male broodfish age on efficiency of artificial fertilization in bighead (*Aristichthys nobilis*). The First National Conference on Aquaculture, Iran-Anzali, November 29-30, 2011 (poster).

Dadras, H., Zahmatkesh, M., Nezami, S., Khara, H. and Baradaran Noveiri, S. 2011b. Investigation of biochemical and ionic characteristics of sperm in different age group in bighead (*Aristichthys nobilis*). The First National Conference on Aquaculture, Iran-Anzali, November 29-30, 2011 (poster).

Dadras, S., Zamini, A. A., Khara, H., Ghanaatparast, A. and Darvishi, S. 2009. Comparison of effects on hypophysis treatment with HCG and metoclopramide in the efficiency of artificial propagation on bream reproduction fishes (*Abramis brama orientalis* Berg 1905). Journal of Fisheries, 3(3):57-64. In Farsi.

Daei S., Jamili S., Mashinchian, A. and Ramin, M. 2009. Effect of Pb and Cd on the iron solute in blood (*Chalcalburnus chalcoides*). Journal of Fisheries and Aquatic Science, 4(6):323-329.

Daghigh Roohi, J. 1997. Tench, *Tinca tinca*, and its parasitic infections in Anzali Wetland. M.Sc. Thesis, University of Tehran. 163 pp. In Farsi.

Daghigh Roohi, J. 2016. Study of parasites occurrence and intensity in fishes of Anzali Lagoon. Iranian Fisheries Science Research Institute, Tehran. 42 pp. In Farsi.

Daghigh Roohi, J., Dalimi, A., Pourkazemi, M., Ghasemi, M. and Shamsi, S. 2019. Morphometric and molecular characterization of *Dactylogyrus lamellatus* isolated from farmed grass carp, *Ctenopharyngodon idella* (Valenciennes, 1844) in Guilan province, Iran. Iranian Journal of Fisheries Sciences, 19(3):1051-1061.

Daghigh Roohi, J., Dalimi Asl, A., Pourkazemi, M., Ghasemi, M. and Shamsi, S. 2017a. Morphometric and molecular analysis of *Dactylogyrus lamellatus* in cultured grass carp, *Ctenopharyngodon idella* of Guilan Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Daghigh Roohi, J., Dalimi Asl, A., Pourkazemi, M., Ghasemi, M. and Shamsi, S. 2017b. Morphometric and molecular analysis of *Gyrodactylus sprostonae* in silver carp, *Hypophthalmichthys molitrix*, of Guilan Province fish farms. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Daghigh Roohi, J., Dalimi Asl, A., Pourkazemi, M. and Shamsi, S. 2019. Occurrence of dactylogyrid and gyrodactylid Monogenea on common carp, *Cyprinus carpio*, in the southern Caspian Sea Basin. Parasitology International, 73:101977.

Daghigh Roohi, J., Dalimi Asl, A. H., Pourkazemi, M., Ghasemi, M. and Shamsi, Sh. 2019. Morphometric and molecular identification of *Gyrodactylus sprostonae* in Guilan Province warm water fishes with an attitude of intensity and prevalence in selected farms. Iranian Veterinary Journal, 15(2):50-58. In Farsi.

Daghigh Roohi, J., Ghasemzadeh, K. and Amini, M. 2016. Occurrence and intensity of parasites in goldfish (*Carassius auratus* L.) from Guilan Province fish ponds, north Iran. Croatian Journal of Fisheries, 74(1):20-24.

Daghigh Roohi, J., Ghoroghi, A., Jalali, S. H., Sadrian, M., Rafipoor, F. and Faied, M. 2013. The effects of ascorbic acid and packaging methods on quality and shelf life of uncoated burger made from silver carp (*Hypophthalmichthys molitrix*) stored at -18°C. Journal of Fisheries Science and Technology, 1(1):13-25. In Farsi.

Daghigh Roohi, J., Mirzajani, A. R., Abedini, A., Samadzadeh, M., Sabkara, J., Abbasi, K. and Khatib, S. 2018. Assessment of bio communities, water quality and aquaculture potential of Ardalan dam reservoir in East Azarbaijan province. Iranian Scientific Fisheries Journal, 27(4):97-105. In Farsi.

Daghigh Roohi, J., Pazooki, J. and Sattari, M. 2015. The first record of *Pomphorhynchus laevis* (Acanthocephala) in chub, *Squalius cephalus* (Linnaeus, 1758) from Gamasiab River, Hamedan, Iran. Caspian Journal of Environmental Sciences, 13(2):173-178.

Daghigh Roohi, J., Sattari, M., Nezamabadi, H. and Ghorbanpour, N. 2014. Occurrence and intensity of parasites in Prussian carp, *Carassius gibelio* from Anzali wetland, southwest Caspian Sea. Iranian Journal of Fisheries Sciences, 13(2):276-288.

Dahmardeh, F., Gharaei, A., Mirdar Harijani, J., Jamshidian, A. and Rahdari, A. 2021. Investigation of pancreatic digestive enzymes changes from egg to larvae phase of *Schizothorax zarudnyi*. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 8 pp. In Farsi.

Dahmardeh, M., Dahmardeh, M., Yazdani, S. and Piri, E. 2009. The socio-economic effects of Hamoon Lake in Sistan region of Iran. Journal of Food, Agriculture and Environment, 7(2):799-802.

Dahmardeh Behrooz, R., Sahebi, S. and Sepehrikia, S. 2012. Mercury contamination in muscle and scales of grass carp (*Ctenopharyngodon idella*) and silver carp (*Hypophthalmichthys molitrix*) of Zabol Chahnimeh Reservoirs (Iran). World Applied Sciences Journal, 20(4):565-569.

Dahmardeh Behrooz, R. D., Sahebi, S., Majnoni, F., Ahmadpour, M. and Hoseini, S. H. 2013. Mercury contamination in commercial fresh and salt water fish of the Zabol Chahnimeh reservoirs and the Gulf of Oman (Iran). Food Additives & Contaminants: Part B: Surveillance, 6(3):175-180.

Daliri, M., Moradinassab, G. and Paighambari, S. Y. 2012. The CPUE variations of *Rutilus frisii kutum* in the beach seine fishing grounds of Guilan province in the last decade. The First National Conference on Catch and Exploitation of Aquatic Animals Stocks, Islamic Azad University of Abadan, December 2012, pp. 267-272. In Farsi.

Dalvand, M. and Lahijani, H. A. K. 2015. Scientometric and historiographical maps of scientific products of Iranian marine researchers on Caspian Sea basin in “Web of Science” during 1992-2013. Journal of Oceanography, 6(22):49-57. In Farsi.

Danaie, A., Patimar, R., Bahalkeh, A. and Azizi, S. 2017. Length-weight relation and condition factor of *Alburnoides* cf. *tabarestanensis* in Mobarak Abad River of Minodasht - Golestan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Danaie, A., Patimar, R., Bahalkeh, A. and Azizi, S. 2018. Growth patterns of *Alburnoides* cf. *tabarestanensis* in Mobarakabad River of Minoodasht-Golestan Province. Journal of Fisheries (Iranian Journal of Natural Resources), 71(2):118-230. In Farsi.

Danesh-e-Khoshasi, A. 1997. Fish culture experiments with *Abramis brama orientalis* in earthen pond to diversify aquaculture fish composition in Iran. Iranian Scientific Fisheries Journal, 5(4):49-62, 5-6. In Farsi.

Danesh-e-Khoshasi, A. 1998. Semi-natural breeding of Chinese carps. Iranian Scientific Fisheries Journal, 6(4):19-34, 3. In Farsi.

Danesh Khoosh Asl, A. 1998. The role of stock enhancement of kutum on quality and quantity of resources in the Caspian Sea. The Seventh National Fisheries Conference, Responsible Fisheries. Shilat Company, Tehran. pp. 207-219. In Farsi.

Danesh Khoshasi, A. 1997. Culturing of *Rutilus frisii kutum*, a fish species of the Caspian Sea, to marketable size. Iranian Scientific Fisheries Journal, 6(3):49-58, 6-7. In Farsi.

Danesh Pajooh, R., Reyahi Khoram, M., Cheraghi, M. and Mohamad Poor Roodposhty, G. A. 2016. Environmental effects of the cold water fish farms effluents on the water quality of Gamasyab River as their main source of water quality supply in the west of Iran. Iranian Journal of Fisheries Sciences, 15(4):1568-1580.

Daneshian, M., Kasiri, H., Hedayati, S. A. A. and Khosrowiani, K. 2017. Detection of lethal concentration (LC_{50}-96h) of arsenic and cadmium in roach (*Rutilus caspicus*). Journal of Utilization and Cultivation of Aquatics, 6(3):61-67. In Farsi.

Daniali, S. R., Soltani, M., Kamali, A. and Shamsaei, M. 2015. Evaluation of environmental stressors factors on rainbow trout in Hanna Reservoir. International Journal of Review in Life Sciences, 5(2):1273-1279.

Daniali, S. R., Soltani, M., Kamali, A. and Shamsaei, M. 2017. The effects of *Oncorhynchus mykiss* culture on the limnological conditions of Hanna Reservoir, Isfahan, Iran. Iranian Journal of Fisheries Sciences, 16(3):1085-1097.

Daoud, A. 1978. Contribution à la connaissance de la biologie de *Barbus xanthopterus*, poisson, cyprinidé du lac Dokan. Doctoral Thesis, Academie Montpellière, France. 88 pp.

Daoud, H. A. M. and Qasim, H. 1999. Some observations on the biology of Chondrostoma regium (Heckel) from Tigris River. Ibn Al-Haitham Journal for Pure and Applied Sciences, 10(2):1-9.

Darabi, A. 1999. Investigation on age and growth of bleak *Chalcalburnus chalcoides* and Caspian vimba *Vimba vimba persa*. B.Sc. Project, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan. 72 pp. In Farsi.

Darabi, A., Kashan, N., Fayazi, J., Aminafshar, M. and Chamani, M. 2014. Phylogenetic relationships of sub-populations of *Barbus sharpeyi* fish in southwest of Iran using mitochondrial DNA with PCR-sequencing method. International Journal of Biosciences, 5(2):41-46.

Darabi, A. R., Kashan, N., Fayazi, J., Aminafshar, M. and Chamani, M. 2015. Investigation of phylogenetic relationship among two *Barbus* species (Cyprinidae) populations with mitochondrial DNA using PCR-sequencing. International Journal of Biology, Pharmacy and Allied Sciences, 4(2):302-311.

Darabi, M., Mostafavi, H., Rahimi, R., Teimori, A., Farshchi, P. and Bali, A. 2021. Modelling of habitat suitability for *Cyprinion watsoni* (*sic,* but *Cyprinion tenuiradius* in text) and determining the impact of climate change on its distribution. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.

Darafsh, F., Mashinchian, A., Fatemi, M. and Jamili, S. 2008. Study of the application of fish scale as bioindicator of heavy metal pollution (Pb, Zn) in the *Cyprinus carpio* of the Caspian Sea. Research Journal of Environmental Sciences, 2(6):438-444.

Dartay, M. and Gül, M. R. 2014. Length-weight relationships for five fish species caught in Keban Dam Lake, Turkey. Journal of Applied Ichthyology, 30(1):233-234.

Darvish Bastami, K. and Imanpour, M. R. 2009. Survey of effects of different concentrations of electrolytes and pH on characterization of sperm motility in wild carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 18(2):27-34. In Farsi.

Darvish Bastami, K., Rezaei, M., Haghparast, S., Eghtesadi Araghi, P., Najafi Hajivar, E., Khansari, A., Jam. A. and Faraz Ghasemi, A. 2012. A comparative study on the biochemical parameters of seminal and blood plasma and their correlation in the wild common carp (*Cyprinus carpio*). Comparative Clinical Pathology, 21(5):781-784.

Darvish Bastami, K., Shabani, N., Imanpour, M. R. and Afkhami, M. 2013. Fatty acid composition of ovule in kutum (*Rutilus frisii kutum* Komensky (*sic*), 1901). Comparative Clinical Pathology, 22(5):965-970.

Darvish Bastami, K., Shabani, N., Soltani, F. and Afkhami, M. 2012. A survey on ionic and metabolite factors of blood serum in kutum (*Rutilus frisii kutum*). Comparative Clinical Pathology, 21(6):1193-1195.

Darvishi, A., Zakeri, M. and Hosseini, S. M. 2016. Comparison of fatty acids profile in the muscles, liver and carcass of wild and cultured benni, *Mesopotamichthys sharpeyi*. Journal of Animal Environment, 8(3):103-114. In Farsi.

Darvishi, P., Javanshir, A. and Nasri, M. 2018. Identification of species diversity in Khorammrud River in Lorestan Province. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Darvishvand, S., Ebrahim, R. and Saberian, N. 2017. Lorestan cave fish barb. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 662-669. In Farsi.

Daryanabard, Gh. R., Fazli, H., Taghavi Motlagh, S. A., Bandani, Gh. A. and Poorgholami Moghadam, A. 2019. Age, growth and biomass of the kutum (*Rutilus frisii*, Kamensky, 1901) in Iranian waters of the Caspian Sea. Iranian Scientific Fisheries Journal, 28(4):79-87. In Farsi.

Daryayelaal, H., Hosseinifard, S. M. and Aliakbarpour, A. 2017a. Study on effect of rice hull extract on survival rate and some nutritional factors in Ghold (*sic*) fish (*Carassius auratus*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 113-119. In Farsi.

Daryayelaal, H., Hosseinifard, S. M. and Aliakbarpour, H. 2017b. Study on effect of rice hull extract on some growth factors in Ghold (*sic*) fish (*Carassius auratus*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 121-126. In Farsi.

Daştan, S. D., Bardakci, F. and Degerli, N. 2012. Genetic diversity of *Cyprinion macrostomus* Heckel, 1843 (Teleostei: Cyprinidae) in Anatolia. Turkish Journal of Fisheries and Aquatic Sciences, 12(3):471-479.

Dastegir, T., Dezfulian, A. and Khodadadi, M. 2013. Study of ovary morophocytological indexes (*sic*) of Benni (*Barbus sharpeyi*) in Shadegan Wetland. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 44 (abstract).

Dastegir, T., Khodadadi, M. and Dezfulian, A. 2013. Study on morophocytological indexes (*sic*) of testis in Benni (*Mesopotamichthys sharpeyi*) from Shadegan Wetland. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 45 (abstract).

Datta, M. N. 1937. Description of the male of *Eosentis rigidus* Van Cleave occurring in the intestine of *Scizothorax* (*sic*) *zarudnyi* from Seistan. Records of the Indian Museum, 39:303-304.

Davodi, M., Esmaili Sari, A., Bahramifar, N. and Rajaii, F. 2009. Study of concentration of organochlorine pesticides in common carp (*Cyprinus carpio*) from Shadegan Wetland. Journal of Marine Sciences and Technology, 8(1-2): 56-64. In Farsi.

Davodi, M., Esmaili-Sari, A. and Bahramifarr, N. 2011. Concentration of polychlorinated biphenyls and organochlorine pesticides in some edible fish species from the Shadegan Marshes (Iran). Ecotoxicology and Environmental Safety, 74(3):294-300.

Davodi, M., Esmaili-Sari, A., Bahramifarr, N. and Zamani Ahmadmahmoudi, R. 2010. Investigation of concentration and pattern of polychlorinated biphenyls (PCBs) distribution in five edible fish species from Shadegan Wetland. Veterinary Journal (Pajouhesh va Sazandegi), 23(3)(88):52-59. In Farsi.

Davoudzadeh, M. 1997. Iran, pp. 384-405. In: Moores, E. M. and Fairbridge, R. W. (Eds.). Encyclopedia of European and Asian Regional Geology. Chapman and Hall, London.

Dawoud, M. A. O. and Koshio, S. 2016. Recent advances in the role of probiotics and prebiotics in carp aquaculture: A review. Aquaculture, 454:243-251.

Day, F. 1872. Monograph of Indian Cyprinidae, (Part VI). Journal of the Asiatic Society of Bengal, 41(2):318-327.

Day, F. 1875-1878. The Fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon. London. Volume 1, Text: xx + 778 pp. Volume 2, Atlas - containing 198 plates.

Day, F. 1876. On the fishes of Yarkand. Proceedings of the Zoological Society, London, 1876:781-807.

Day, F. 1878. Scientific Results of the Second Yarkand Mission; based upon the collections and notes of the late Ferdinand Stoliczka, Ph.D. Ichthyology. Superintendent of Government Printing, Calcutta. 25 pp., plates I-V.

Day, F. 1880. On the fishes of Afghanistan. Proceedings of the Zoological Society, London, 1880:224-232.

Day, F. 1888. Supplement to the Fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon. Williams and Norgate, London. pp. 779-816.

Day, F. 1889. The Fauna of British India including Ceylon and Burma. Fishes. Taylor and Francis, London. 2 volumes, xx + 548 pp., xiv + 509 pp.

Dayer, M. R., Dayer, M. S. and Moosavi Movahedi, A. A. 2014. A tri state mechanism for oxygen release in fish hemoglobin: Using *Barbus sharpeyi* as a model. Molecular Biology Research Communications, 3(2):101-113.

De Bruyn, C. 1711. Reysen over Muscovien door Persien en Indien. Amsterdam (another Dutch edition published in 1714; French editions (under Corneille Lebrun) at Amsterdam in 1718 as:- "Voyages par la Moscovie, en Perse et aux Indes Orientales, ouvrage enrichi de plus de 300 tailles douces des plus curieuses representent les animaux, les oiseaux, les poissons et les plantes,".... with 320 plates, and at Rouen in 1725 in 5 volumes; English edition at London in 1737 as:- "Travels into Muscovy, Persia, and part of the East Indies", in 2 volumes).

De Filippi, F. 1863. Nuove o poco note specie di animali vertebrati raccolte in un viaggio in Persia nell'estate dell'anno 1862. Archivio per la Zoologia, l'Anatomia e la Fisiologia, Modena, 2(2):377-394.

De Filippi, F. 1864. Riassunto del catalogo degli animali vertebrati delle provincie caucasiche e della Persia occidentale. Atti della Societa Italiana di Scienze Naturale di Milano, 7:184-186.

De Filippi, F. 1865. Note de un viaggio in Persia nei 1862. Pesci, pp. 3, 63, 141, 357-360. G. Daelli & C. Editori, Milano. viii + 396 pp.

Dehghan Madiseh, S., Esmaily, F., Nilsaz, M. Kh., Mazreavy, M., Sabzalizadeh, S., Jahani, N., Eskandary, Gh., Kianersi, F., Banitorfyzadegan, J. and Albo Obid, S. 2018. Survey on

ecological characteristics of Horolazim wetland in Khouzestan (2012-2013). Iranian Fisheries Science Research Institute, Tehran. 240 pp. In Farsi.

Dehghani, S., Akbari, S., Soltanian, S., Shamsaei, H. A. and Parvizi, S. 2012. Comparison of tissue-specific Cu bioaccumulation patterns and sensitivity to waterborne Cu in two freshwater fish: common carp (*Cyprinus carpio*) and its subspecies mirror carp. World Journal of Fish and Marine Sciences, 4(4):349-3554.

Dehghani, S. N., Maleki, M. and Akbari, S. 1998. The clinical study of wound healing after laparatomy (*sic*) in *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 6(4):87-94, 8-9. In Farsi.

Dehghani Firoozabadi, F., Motamedi, N. and Eagderi, S. 2014. Comparison of morphological characteristics of lapillus ear stone in four species of the genus *Capoeta* in Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Dehghani Ghomshani, M., Mazandarani, M., Soudagar, M. and Hoseini, S. M. 2017. Haematological study of safflower (*Carthamus tinctorius*) extract fed common carp (*Cyprinus carpio*) fingerlings exposed to sub lethal salinity stress. Journal of Utilization and Cultivation of Aquatics, 5(4):55-69. In Farsi.

Dehghannezhad, R., Zamani-Ahmadmahmoodi, R., Shaluei, F. and Gharahi, N. 2019. Study of the trophic status of Choghakhor wetland using a trophic state index, in Chaharmahal and Bakhtiari Province, Iran. Journal of Wetland Ecobiology, 11(3):5-14. In Farsi.

Dehkordi, S. K. and Bani, A. 2016. Day-night behavior in river entry of kutum and its relation to meltonin and LH. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Dehkordi, S. K., Tilami, S. K. and Namin, J. I. 2016. Induced histopathological alterations in selected organs of *Rutilus kutum* exposed to polluted waters in Anzali Lagoon. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Dehmarde, H., Gharaei, A. and Ghaffari, M. 2013. Effect of various levels of dietary carbohydrate on growth parameters and body chemical analysis of snow trout juveniles (*Schizothorax zarudnyi*). Iranian Aquaculture Society Journal, 1(2):63-73. In Farsi.

Dejandian, S., Sadeghinezhad, E., Bourani, M. S., Jourdehi, A. Y., Ahmadnezhad, M. and Hosseinjani, A. 2017. Gonad development and growth in *Aspius aspius* fish. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Delangizan, S., Moradpour Oladi, M. and Najafi, Z. 2011. The estimated fisheries supply in Kermanshahan Province. Journal of Fisheries, 5(2):17-28. In Farsi.

Delashoub, M. 2016. Histomorphologic study of the bucco-pharynx of bighead carp, (*Hypophthalmichthys nobilis*). The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Delavar, M. and Booij, M. J. 2020. Impacts of land use changes and climate variability on transboundary Hirmand River using SWAT. Journal of Water and Climate Change, 11(4):1695-1711.

Delavariyan, R., Aberoumond, A., Ziaei Nejad, S. and Javaheri Baboli, M. 2014. Effects of dietary replacement of fish oil by vegetables oil (palm and soybean oil) on growth and nutrition indicators and survival rate of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 8(3):43-51. In Farsi.

Deldar, H., Khayatzadeh, J. and Tehranipour, M. 2016. Investigating the protective effect of alfalfa with copper nanoparticle treatment on gill and skin histochemistry and development of koi (*Cyprinus carpio*). The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Delshad, M., Ahamdifard, N., Atashbar, B. and Kamali, M. 2018. Water quality survey of the Gharehsou River in Ardabil in the range of rainbow trout farms. Iranian Scientific Fisheries Journal, 27(2):1-12. In Farsi.

De Mecquenem, R. 1908. Le lac d'Ourmiah. Annales de Géographie, Paris, 17:128-144.

De Menasce, J. P. 1966. Textes Pehlevis sur les qanats. Acta Orientalis, 30:167-175.

de Moor, J. 1998. In the beginning was fish. Fish in the ancient Near East, pp. 84-93. In: Walker, H. (Ed.). Fish. Food from the Waters. Proceedings of the Oxford Symposium on Food and Cookery 1997. Prospect Books, Totnes, Devon. 335 pp.

Department of Environment-IR Iran and UNDP-Iran. 2014. Towards a solution for Iran's drying wetlands. Conclusions and recommendations. International Technical Round Table, 16-18 March 2014, Tehran. 29 pp.

Derakhshan, Z., Mahvi, A. H., Faramarzian, M., Deghani, M., Salari, M., Fakhri, Y., Afsharnia, M., Hosseini, M. S., Marzban, A. and Taghavi, M. 2018. Data on heavy metal concentration in common carp fish consumed in Shiraz, Iran. Data in Brief, 21:1890-1894.

Derzhavin, A. N. 1926. Ryby reki Kara-su [Fishes of the Kara-su River]. Izvestiya Bakinskoi Ikhtiologicheskoi Laboratorii, 2(1):161-184.

Derzhavin, A. N. 1929a. Kurinskoe rybnoe khozyastvo i melioratsiya mugani [The fisheries of the Kura and the melioration of the Mugan]. Izvestiya Bakinskoi Ikhtiologicheskoi Laboratorii, 2(2):1-68.

Derzhavin, A. N. 1929b. Zametka o rybakh reki Keredzh (sev. Persiya) [A note on fishes of the River Karaj (North Persia)]. Izvestiya Bakinskoi Ikhtiologicheskoi Laboratorii, 2(2):69-79.

Derzhavin, A. N. 1934. Presnovodnye ryby yuzhnogo poberezh'ya Kaspiya. Vstuplenie [Freshwater fishes of the southern shore of the Caspian Sea. Introduction]. Trudy Azerbaidzhanskogo Otdeleniya Zakavkazskogo Filiala Akademii Nauk SSSR, Sektor Zoologii, Baku, 7:91-126.

Dezfouli, I. B. 1996. Iran. Report on land and water laws and institutions. Food and Agriculture Organization, Rome, Technical Cooperation Programme, TCP/IRA/4452:28 pp.

Diagomanolin, V., Farhang, M., Ghazi-Khansari, M. and Jafarzadeh, N. 2004. Heavy metals (Ni, Cr, Cu) in the Karoon waterway river, Iran. Toxicology Letters, 151(1):63-68.

Diemel, A. 1926. Fisch-Texte der Zeit Urukaginas. Orientalia, 21:40-83.

Diester-Haass, L. 1973. Holocene climate in the Persian Gulf as deduced from grain-size and pteropod distribution. Marine Geology, 14(3):207-223.

Dimand, M. S. 1934. Persian miniatures of the Fourteenth Century. Bulletin of the Metropolitan Museum of Art, New York, 29(4):58-60.

Djahed, B., Narooie, M. R., Kazeminejad, S. A., Shahsavani, E. and Bazrafshan, E. 2016. Water quality assessment of Dorudzan Reservoir, Shiraz, Iran, for drinking and irrigation uses. Iranian Journal of Health Sciences, 4(2):1-10.

Doadrio, I. 1990. Phylogenetic relationships and classification of western palaearctic species of the genus *Barbus* (Osteichthyes, Cyprinidae). Aquatic Living Resources, 3(4):265-282.

Doadrio, I. and Carmona, J. A. 2004. Phylogenetic relationships and biogeography of the genus

Chondrostoma inferred from mitochondrial DNA sequences. Molecular Phylogenetics and Evolution, 33(3):802-815.

Doadrio, I. and Carmona, J. A. 2006. Phylogenetic overview of the genus *Squalius* (Actinopterygii: Cyprinidae) in the Iberian Peninsula, with description of two new species. Cybium, 30(3):199-214.

Doğaç, E., Ağdamar, S., Keskin, E., Tarkan, A. S., Yapıcı, S. and Acar, Ü. 2015. Mitochondrial genetic variations of an introduced freshwater fish, goldfish *Carassius auratus* at the frontier between Europe and Asia (western Anatolia, Turkey): proximity to Europe rather than East Asia?. Mitochondrial DNA, 27(6):4008-4014.

Dogu, Z., Aral, F. and Sahinöz, E. 2013. The embryonic and larval development of *Capoeta trutta* (Heckel, 1843). Indian Journal of Animal Research, 47(6):527-532.

Dolatpour, E., Poorbagher, H., Eagderi, S. and Javanshir, A. 2014. Study of some biological characteristics of tuini fish (Cyprinidae: *Capoeta damascina*) in Kordan River of Alborz Province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Dolatpour, E., Poorbagher, H., Eagderi, S. and Javanshir, A. 2016. A study on habitat preferences of tuini fish (*Capoeta damascina*) using the habitat suitability index in the Kordan River. Journal of Fisheries (Iranian Journal of Natural Resources), 69(3):359-366. In Farsi.

Dollfus, R. Ph. 1970. D'un cestode ptychobothrien parasite de cyprinide en Iran. Mission C.N.R.S. (Théodore Monod), février 1969). Bulletin du Muséum national d'Histoire naturelle, Paris, série 2, 41(6):1517-1521.

Dominguez, F. J., Lowry, R. L. and Webb, C. E. 1951. Report of the Helmand River Delta Commission Afghanistan and Iran. Washington, D.C. 150 pp., 2 figs.

Dopeikar, H. and Keivany, Y. 2015a. On some feeding features of the Kura barb (*Barbus lacerta*) in Bibi-Sayyedan River of Semirom, Isfahan. Journal of Fisheries, 68(2):225-238. In Farsi.

Dopeikar, H. and Keivany, Y. 2015b. Population dynamic study of Kura barb (*Barbus lacerta*: Cyprinidae) in Tigris basin. Romanian Journal of Biology (Zoology), 60(2):101-112.

Dopeikar, H., Keivany, Y. and Shadkhast, M. 2011. Determining spawning peak of the Kura barb (*Barbus lacerta* Heckle, (*sic*) 1843, based on fluctuations in gonadosomatic and hepatosomatic indices. National Congress on Aquatic Animals and Food, Bushehr, Iran (abstract).

Dopeikar, H., Keivany, Y. and Shadkhast, M. 2015. Reproductive biology and gonad histology of the kura barbel, *Barbus lacerta* (Cyprinidae), in Bibi-Sayyedan River, Tigris basin. North-Western Journal of Zoology, 11(1):163-170.

Dorafshan, S. and Heyrati, F. P. 2006. Spawning induction in kutum *Rutilus frisii kutum* (Kamenskii, 1901) using carp pituitary extract or GnRH analogue combined with metoclopramide. Aquaculture Research, 37(8):751-755.

Dorafshan, S. and Kalbasi, M. R. 2007. Karyological study of *Ctenopharyngodon idella* ♀ *Hypophthalmichthys nobilis* ♂ F1 hybrids. Iranian Journal of Biology, 20(2):277-285. In Farsi.

Dorafshan, S., Moslehi, S. and Paykan Heyrati, F. 2012. Comparison of carcass quality of two cyprinid fish, common carp, *Cyprinus carpio* and kawar, *Squalius lepidus*. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-

12 December 2012, Karaj, Iran, p. 803.
Dorafshan, S., Mostafavi, H. and Mojazi Amiri, B. 2003. Induction of spawning in common carp (*Cyprinus carpio*), using pituitary extract and GnRH analogue in combination with domperidone. Iranian Journal of Biotechnology, 1(4):213-217.
Dorafshan, S. and Roozdar, A. 2016. Karyological analysis of small-scaled Damascus barbel, *Capoeta damascina* (Valenciennes, 1842) from Tigris Basin. Iranian Journal of Fisheries Sciences, 15(1):542-551.
Dorafshan, S., Shafee, Z. and Keivany, Y. 2014. A study on genetic differentiation in two species of Iranian bleaks, (*Alburnus mossulensis*) and (*Alburnus caeruleus*) Teleostei, Cyprinidae using simple sequence repeats. Caspian Journal of Environmental Sciences, 12(2):197-204.
Dordi Tatr, R., Ghorbani, R., Gorgin, S., Bandani, Gh. and Yahyaei, M. 2018. Assessing exploitation status of Caspian roach (*Rutilus caspicus*, Yakovlev, 1870) in southeast of the Caspian Sea. Iranian Scientific Fisheries Journal, 27(4):67-76. In Farsi.
Dorofshan, S., Shojaee, N. and Mirghaffari, N. 2015. Heavy metals (Cd and Cr) concentration in different tissues (muscle, gill, kidney and intestine) of Zayandehrood chub, *Petroleuciscus esfahani*. Iranian Scientific Fisheries Journal, 24(2):43-52. In Farsi.
Dorostghoal, M., Peyghan, R., Papan, F. and Khalili, L. 2009. Macroscopic and microscopic studies of annual ovarian maturation cycle of Shirbot *Barbus grypus* in Karoon River of Iran. Iranian Journal of Veterinary Research, Shiraz University, 10(2)(27):172-179.
DouAbul, A. A. Z., Al-Omar, M., Al-Obaidy, S. and Al-Ogaily, N. 1987. Organochlorine pesticide residues in fish from the Shatt al-Arab River, Iraq. Bulletin of Environmental Contamination and Toxicology, 38(4):674-680.
DouAbul, A. A. Z., Al-Saad, H. T. and Al-Rekabi, H. N. 1987. Residues of organochlorine pesticides in environmental samples from the Shatt al-Arab River, Iraq. Environmental Pollution, 43(3):175-187.
DouAbul, A. A. Z., Al-Saad, H. T., Al-Timari, A. A. K. and Al-Rekabi, H. N. 1988. Tigris-Euphrates delta: a major source of pesticides to the Shatt al-Arab River (Iraq). Archives of Environmental Contamination and Toxicology, 17(3):405-418.
Doustdar, M. and Ramin, M. 2016. Investigation of fish species belonging to the genus *Luciobarbus* in Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Doustdar, M. and Ramin, M. 2018. Necessity for conservation of ecological fishes in Urmia Lake basin. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Doustdar, M., Ramin, M., Nasrollahzadeh Saravi, H., Afraei, M. A. and Rahmai, R. 2018. Investigation and determination of some heavy metals in the Aras River fish species in the East Azarbaijan Province (2015-16). Iranian Scientific Fisheries Journal, 27(3):41-49. In Farsi.
Dragomirescu, L., Constantinescu, V. and Bănărescu, P. M. 1985. A numerical taxonomic method adequate to the biological thinking. Applications: Watanabe's example and the *Acanthobrama* genus (Pisces, Cyprinidae). Travaux du Muséum d'Histoire Naturelle "Grigore Antipa", Bucureşti, 27:243-265.
Dresch, J. 1975. Bassins arides iraniens. Bulletin de l'Association de Géographes Français, 430:337-351.
Dudgeon, D. 2020. Freshwater Biodiversity. Status, Threats and Conservation. Cambridge

University Press. 514 pp.
Dugan, P. (Ed.). 1993. Wetlands in Danger. A World Conservation Atlas. Oxford University Press, New York. 193 pp.
Duman, E and Duman, M. 1996. Keban Baraj Gülü'nden Avlanan *Capoeta trutta* Heckel, 1843 Ile *Barbus rajanorum mystaceus* Heckel, 1843'ün et Verimi Besin Değerleri [Meat yield and nutritional value of *Capoeta trutta* Heckel, 1843 and *Barbus rajanorum mystaceus* Heckel, 1843 caught from Keban Dam Lake]. Su Ürünleri Dergisi, 13 (1-2):83-88.
Duman, E. and Şen, D. 1995. Keban Baraj Gölü'nde Yaşayan *Barbus xanthopterus* (Heckel, 1843)'da Karşılaştırmalı Yaş Tayini [Comparative age determination of *Barbus xanthopterus* (Heckel, 1843) living in Keban Dam Lake. Su Ürünleri Dergisi, 12(3-4):293-297.
Dumont, H. 1995. Ecocide in the Caspian Sea. Nature, London, 377(6551):673-674.
Dumont, H. J. 1998. The Caspian Lake: history, biota, structure, and function. Limnology and Oceanography, 43(1):44-52.
Dumont, H. J. 2002. Possible consequences of the *Mnemiopsis* invasion for the biodiversity of the Caspian Sea. First International Meeting "The invasion of the Caspian Sea by the comb jelly *Mnemiopsis* - problems, perspectives, need for action", Baku, Azerbaijan, 24-26 April 2001. Caspian Environment Programme, Baku, Azerbaijan. 1 p.
Dunin-Barkovsky, L. V. 1977. Integrated historical-archeological and paleogeographical studies of drainless lakes in the USSR, pp. 91-94. In: Greer, D. C. (Ed.). Desertic Terminal Lakes. Utah State University. 436 pp.
Durand, J. D., Persat, H. and Bouvet, Y. 1999. Phylogeography and postglacial dispersion of the chub (*Leuciscus cephalus*) in Europe. Molecular Ecology, 8(6):989-997.
Durand, J.-D., Tsigenopoulos, C. S., Ünlü, E. and Berrebi, P. 2002a. Phylogeny and biogeography of the Family Cyprinidae in the Middle East inferred from cytochrome b DNA - evolutionary significance of this region. Molecular Phylogenetics and Evolution, 22(1):91-100.
Durand, J.-D., Tsigenopoulos, C. S., Ünlü, E. and Berrebi, P. 2002b. Erratum to "Phylogeny and biogeography of the Family Cyprinidae in the Middle East inferred from cytochrome b DNA - evolutionary significance of this region" [Mol. Phylogenet. Evol. 22(2002) 91-100]. Molecular Phylogenetics and Evolution, 25(1):218.
Durand, J. D., Ünlü, E., Doadrio, I., Pipoyan, S. and Templeton, A. R. 2000. Origin, radiation, dispersion and allopatric hybridization in the chub *Leuciscus cephalus*. Proceedings of the Royal Society of London, Series B, Biological Sciences, 267(1453):1687-1697.
Dürkoop, A., Leimbach, F. and Wilde, S. 1979. Bibliographie der geologischen Literatur des Iran bis 1978. Bochumer geologische und geotechnische Arbeiten, 2:iii + 149 pp.

E

Eadoollah, A. 1992. Rivers of Iran. Ministry of Energy, Jamab Company, Tehran. 2 volumes. In Farsi.
Eagderi, S. 2014. Phenotypic plasticity of body shape in populations of Kura barbel (*Barbus lacerta*, Heckel 1843) in Sefidrud River basin using geometric morphometric technique. Journal of Fisheries Science and Technology, 3(3):91-95. In Farsi.
Eagderi, S., Esmaeilzadegan, E. and Maddah, A. 2013. Body shape variation in riffle minnows (*Alburnoides eichwaldii* De Filippi, 1863) populations of Caspian Sea basin. Journal of

Taxonomy and Biosystematics, 5(14):1-8, 1.
Eagderi, S., Esmaeilzadegan, E. and Pirbeigi, A. 2014. Morphological responses of *Capoeta gracilis* and *Alburnoides eichwaldii* populations (Cyprinidae) fragmented due to Tarik Dam (Sefidrud River, Caspian Sea basin, Iran). Iranian Journal of Ichthyology, 1(2):114-120.
Eagderi, S., Ghojoghi, F. and Nasri, M. 2017. Phylogenetic relationship of members of the genus *Rutilus* Rafinesque, 1820 in the southern Caspian Sea (Bandar Turkman, and Shalman and Aras rivers) based on osteological characters. Journal of Fisheries (Iranian Journal of Natural Resources), 70(2):179-188. In Farsi.
Eagderi, S., Hasanpour, Sh. and Nahavandi, R. 2021. Histological development of eye in Caspian roach, *Rutilus lacustris* (Pallas, 1814) (Teleostei: Cyprinidae) during early development. Journal of Survey in Fisheries Sciences, 7(2):105-111.
Eagderi, S., Jouladeh-Roudbar, A., Birecikligil, S. S., Çiçek, E. and Coad, B. W. 2017. *Chondrostoma esmaeilii*, a new cyprinid species from the Tigris river drainage in Iran (Teleostei: Cyprinidae). Vertebrate Zoology, 67(2):125-132.
Eagderi, S., Jouladeh-Roudbar, A., Imani Harsini, J. and Rostami, M. 2019. Phylogeny of the members of the genus *Alburnoides* in Iran using COI gene. Iranian Scientific Fisheries Journal, 28(3):135-136. In Farsi.
Eagderi, S., Kelary Ebrahimi, S., Ashrafi, S. and Jalili, P. 2017. Population variation of *Capoeta heratensis* in Hari River and Dasht-e Kavir basins using geometric morphometric technique. Journal of Aquaculture Sciences, 5(1):37-44. In Farsi.
Eagderi, S., Majazi Amiri, B. and Mirvaghefi A. R. 2006. A histological study of testis structure and reproductive cycle in male bulatmai barbel (*Barbus capito*), migratory to Sefidrood and Polrood rivers. Iranian Journal of Natural Resources, 59(1):139-149. In Farsi.
Eagderi, S., Mojazi Amiri, B. and Adriaens, D. 2013. Description of the ovarian follicle maturation of the migratory adult female bulatmai barbel (*Luciobarbus capito*, Güldenstädt 1772) (*sic*) in captivity. Iranian Journal of Fisheries Sciences, 12(3):550-560.
Eagderi, S. and Moradi, M. 2017. Range extension of the lake goby *Rhinogobius similis* Gill, 1859 (Teleost (*sic*): Gobiidae) to Urmia Lake basin in northwestern Iran. Biharean Biologist, 11(2):123-125.
Eagderi, S., Moshaiedi, F. and Nasri, M. 2019. The morphological variation of four populations of Urmia kingfish (*Alburnus atropatenae*) in Urmia Lake basin using geometric morphometric technique. Journal of Experimental Animal Biology, 7(4):19-28. In Farsi.
Eagderi, S., Mouludi-Saleh, A., Ahmadi, S. and Javadzadeh, N. 2020. Phenotypic plasticity of the body shape in Prussian carp (*Carassius gibelio*), in response to lentic and lotic habitats using geometric morphometric technique. Iranian Scientific Fisheries Journal, 29(1):49-58. In Farsi.
Eagderi, S., Mouludi-Saleh, A. and Çiçek, E. 2020. Length-weight relationship of ten species of Leuciscinae sub-family (Cyprinidae) from Iranian inland waters. International Aquatic Research, 12(2):133-136.
Eagderi, S., Mouludi-Saleh, A., Hosseini, S. V. and Mousavi-Sabet, H. 2021. Documentation of the Turkestan barbel, *Luciobarbus conocephalus* (Kessler, 1872) in the Iranian part of the Hari River basin (Teleostei: Cyprinidae: Barbinae). Iranian Journal of Ichthyology, 8(1):67-75.

Eagderi, S., Mouludi-Saleh, A. and Nazlabadi, S. A. 2019. First record of rohu, *Labeo rohita* (Hamilton, 1822) (Cyprinidae) from Karun River, Tigris River drainage, Iran. FishTaxa, 4(1):18-20.

Eagderi, S., Mouludi-Saleh, A., Rostami, M. and Imani Harsani, J. 2021. Morphological pattern of the genus *Alburnoides* (Pisces: Cyprinidae) in Iranian inland waters using landmark-based geometric morphometric technique. Journal of Fisheries (Iranian Journal of Natural Resources), 74(2):259-269. In Farsi.

Eagderi, S. and Nasri, M. 2012. A first record of the Bittrling (*sic*) *Rhodeus amarus* (Bloch, 1782) Cypriniformes, Cyprinidae) in the Iranian part of Tigris-Euphrates Basin. International Research Journal of Applied and Basic Sciences, 3(3):639-641.

Eagderi, S., Nikmehr, N., Çiçek, E., Esmaeili, H. R., Vatandoust, S. and Mousavi-Sabet, H. 2019. *Barbus urmianus* a new species from Urmia Lake basin, Iran (Teleostei: Cyprinidae). International Journal of Aquatic Biology, 7(4):239-244.

Eagderi, S., Nikmehr, N. and Freyhof, J. 2019. *Alburnus zagrosensis*, a junior synonym of *Alburnus sellal* (Teleostei: Leuciscidae). Zootaxa, 4652(2):367-374.

Eagderi, S., Poorbagher, H., Çiçek, F. and Sungur, S. 2020. Length-weight relationships, condition factor and morphometric characteristics of the spirlin (*Alburnoides* Jeitteles, 1861) species from Iranian inland waters. Journal of Survey in Fisheries Sciences, 7(1):1-7.

Eagderi, S., Poorbagher, H. and Zamani Faradonbe, M. 2016. Habitat suitability index of *Capoeta buhsei* Kessler, 1877 in Jajroud River (Namak Lake basin).m The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Earfani Majd, N., Salamat, N. and Hashami Teba, M. 2010. Pituitary culture media effect on carp incubated ovarian follicles. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Ebadati, N. 2017. Statistical analysis of Dez River water quality, southwest of Iran. Anthropogenic Pollution, 1(1):46-60.

Ebadi, E. G. and Hisoriev, H. 2017. Metal pollution status of Tajan River - northern Iran. Toxicological and Environmental Chemistry, 99(9-10):1358-1367.

Ebadi, A. G. and Shokrzadeh, M. 2006. A survey and measurement of residues of lindane (organochlorine pesticides) in four species of the most consumed fish in the Caspian Sea (Iran). Toxicology and Industrial Health, 22(1):53-58.

Ebadi, A. G. and Zare, S. 2005. Measurement of organophosphorous pesticide in fish from the Tajan River. Pakistan Journal of Biological Sciences 8(10):1463-1465.

Ebadi Fathabad, A., Jafari, K., Tajik, H., Behmanesh, M., Shariatifar, N., Sadat Mirahmadi, S., Conti, G. O. and Miri, M. 2020. Comparing dioxin-like polychlorinated biphenyls in most consumed fish species of the Caspian Sea. Environmental Research, 180:108878.

Ebadi Fathabad, A., Tajik, H., Jafari, K., Hoseinzadeh, E., Sadat Mirahmadi, S., Conti, G. O. and Miri, M. 2020. Evaluation of dioxin-like polychlorinated biphenyls in fish of the Caspian Sea. MethodsX, 7:100803.

Ebadi Fathabad, A., Tajik, H. and Shariatifar, N. 2019. Heavy metal concentration and health risk assessment of some species of fish, Rasht, Iran. Journal of Mazandaran University of Medical Sciences, 28(168):118-132. In Farsi.

Ebrahimi, A. 2015. Study of the digestive tract of a rare species of Iranian blind cave fish (*Iranocypris typhlops*). Biodiversitas, 16(2):173-178.

Ebrahimi, A., Akrami, R., Najdegerami, E. H., Ghiasvand, Z. and Koohsari, H. 2020. Effects of

different protein levels and carbon sources on water quality, antioxidant status and performance of common carp (*Cyprinus carpio*) juveniles raised in biofloc based system. Aquaculture, 516:734639.

Ebrahimi, E., Ahamdniaye Motlagh, H. and Safari, O. 2020. Investigation on the chemical composition and amino acid profile of carcasses and the level of activity of the digestive enzymes of khajoo (*Schizothorax pelzami*) in different longitudinal classes. Journal of Animal Environment, 12(1):173-180. In Farsi.

Ebrahimi, E., Fathi, P., Ghodrati, F., Naderi, M. and Pirali, A. 2018. Assessment of Tajan River water quality with the use of biological and quality indicators. Iranian Scientific Fisheries Journal, 26(5):139-151. In Farsi.

Ebrahimi, E., Kamrani, E., Heydarnejad, M. S. and Safari, O. 2017. Daily rhythms of locomotor and demand-feeding activities in *Schizothorax pelzami* (Kessler, 1870). Chronobiology International, 34(10):1366-1376.

Ebrahimi, G. 2011. Effects of rearing tank background color on growth performance in juvenile common carp, *Cyprinus carpio* L. Agricultural Journal, 6(5):213-217.

Ebrahimi, G. and Ouraji, H. 2012. Growth performance and body composition of kutum fingerlings, *Rutilus frisii kutum* (Kamenskii 1901), in response to dietary protein levels. Turkish Journal of Zoology, 36(4):551-558.

Ebrahimi, G., Ouraji, H., Firouzbakhsh, F. and Makhdomi, C. 2011. Dietary lipid requirement for the kutum fingerlings, *Rutilus frisii kutum* (Kamenskii 1901). World Journal of Zoology, 6(3):255-262.

Ebrahimi, G., Ouraji, H., Khalesi, M. K., Sudagar, M., Barari, A., Zarei Dangesaraki, M. and Jani Khalili, K. H. 2012. Effects of prebiotic, Immunogen® on feed utilization, body composition, immunity and resistance to *Aeromonas hydrophila* infection in the common carp *Cyprinus carpio* (Linnaeus) fingerlings. Journal of Animal Physiology and Animal Nutrition, 96(4):591-599.

Ebrahimi, Kh., Mohammad Nejad Shamoushaki, M., Javadian, R., Keshavarz Divkolaie, M. and Karbakhsh Ravari, A. 2014. Effect of starvation and compensatory growth on carcass quality in *Cyprinus carpio* (Linnaeus, 1758). Journal of Animal Physiology and Development (Journal of Biological Sciences), 7(3):41-48. In Farsi.

Ebrahimi, M. 1999. 17, 20 dihydroxy progesterone (17, 20 DPH) production by different tissue in common carp (*Cyprinus carpio*) and gold fish (*Carasius* (*sic*) *auratus*). Iranian Scientific Fisheries Journal, 8(2):1-14, I. In Farsi.

Ebrahimi, M. 2000. Identification of Kerman fishes. Agricultural and Natural Resources Research Center of Kerman, Iranian Fisheries Research Organization, Ministry of Jihad-e Agriculture. 41 pp. In Farsi.

Ebrahimi, M. 2001. Identification of freshwater fishes in some permanent rivers of Kerman Province. Iranian Scientific Fisheries Journal, 10(3):1-12, 1. In Farsi.

Ebrahimi, M. 2004. Morphological changes of fish sperm affected by copper using (SEM). Iranian Scientific Fisheries Journal, 13(2):1-10. In Farsi.

Ebrahimi, M. 2007. Qanat fishes in Markazi and Sirjan basins of Kerman Province, Iran. Iranian Scientific Fisheries Journal, 16(2):153-160. In Farsi.

Ebrahimi, M., Mohammadi Torkashvand, A. and Moez Aradalan, M. 2015. Effect of integrated cultivation of rice and fish on soil nutrients availability, nutrients uptake and yield of Guilan Province rice field. Journal of Aquaculture Development, 9(3):11-18. In Farsi.

Ebrahimi, M., Nematollahi, A., Samiei, A. and Golabi, M. 2018. Ectoparasitism on freshwater

fish in West Azerbaijan, northwest of Iran. Comparative Clinical Pathology, 27(2):353-356.
Ebrahimi, M., Ramin, M., Afzali, H., Azadshahraki, F. and Eslami, F. 2008. Identification of fresh water fishes in permanent rivers basin of Loot & Sirjan deserts of Kerman Province in Iran. 8th International Congress on the Biology of Fish, Portland, Oregon, 28 July-1 August 2008 (abstract).
Ebrahimi, M., Ramin, M., Nejadhossien (*sic*), M., Yazdan, P. L. and Afzali, H. 2002. Identification of freshwater fishes in some permanent rivers of Kerman Province. International Congress on the Biology of Fish, Congress 2002: Vancouver, Canada. pp. 51-54.
Ebrahimi, M. and Taherianfard, M. 2010a. Concentration of four heavy metals (cadmium, lead, mercury and arsenic) in organs of two cyprinid fish (*Cyprinus carpio* and *Capoeta* sp.) from the Kor River (Iran). Environmental Monitoring and Assessment, 168(1-4):575-585.
Ebrahimi, M. and Taherianfard, M. 2010b. Are the fish captured from Kor River, Fars (Iran), safe to eat? Aquatic Ecosystem and Health Management, 13(1):94-98.
Ebrahimi, M. and Taherianfard, M. 2011a. The effects of heavy metals exposure on reproductive systems of cyprinid fish from Kor River. Iranian Journal of Fisheries Sciences, 10(1):13-24.
Ebrahimi, M. and Taherianfard, M. 2011b. Pathological and hormonal changes in freshwater fishes due to exposure to heavy metals pollutants. Water, Air and Soil Pollution, 217(1-4):47-55.
Ebrahimi, M., Taherianfard, M. and Rafiee, M. M. 2008. Lead contamination in fishes of the Kor River. Iranian Journal of Fisheries Sciences, 7(2):1-14.
Ebrahimi, S. and Moshari, M. 2006. Evaluation of Choghakhor Wetland status with the emphasis on environmental management problems. Publications of the Institute of Geophysics, Polish Academy of Sciences, Water Resources, E-6(390):8 pp.
Ebrahimi Dorche, E., Zare Shahraki, M., Farhadian, O. and Keivany, Y. 2018. Seasonal variation of plankton structure as bioindicators in Zayandehrud Dam Lake, Iran. Limnological Review, 18(4):157-165.
Ebrahimian, M., Shajiee, H. and Sharafi, Sh. 2014. Identification of parasitic worms in Cyprinidae family fishes in main aquatic resources of Semnan Province. Journal of Animal Biology, 7(1):1-12. In Farsi.
Ebrahimpour, M., Pourkhabbaz, A., Baramaki, R., Babaei, H. and Rezaei, M. 2011. Bioaccumulation of heavy metals in freshwater fish species, Anzali, Iran. Bulletin of Environmental Contamination and Toxicology, 87(4):386-392.
Ebrahimzadeh, A. and Kailani, R. 1976. Survey on the parasites of digestive organs, gills and muscles of Karun River fishes. Chamran University Publication, Ahvaz, 110:1-22. In Farsi.
Ebrahimzadeh, A. and Kilany-Damawandy, R. 1977. Parasitic infections in the fish or (*sic*) Karoon River in Province Khouzestan (Southwest Iran), p. 130. Summaries of the First Mediterranean Conference on Parasitology, Izmir, Turkey, 5-10 October 1977.
Ebrahimzadeh, A. and Nabawi, L. 1975. Survey of the parasites in the fishes of Karun River. Chamran University Publication, Ahvaz, 81:1-35. In Farsi.
Ebrahimzadeh, H. A. 1999. Evaluation of toxigenic fungi at Cyprinid Farm in Northern Iran. In: 26th World Veterinary Congress, Lyon, France, 23-26 September 1999 (abstract).
Ebrahimzadeh, M., Kalbassi, M. R., Nazari, R. M. and Behrozi, S. H. 2003. Comparison of some

biological parameters between grass carp and female grass carp x male bighead carp hybrid. Journal of Marine Sciences and Technology, 2(2-3):1-10. In Farsi.

Ebrahimzadeh, M. A., Karami, M. and Golrokh, M. 2004. Measurements of ache activity in the brain of sea, well- and river-fed white fish (*Rutilus frisi* (*sic*) as a health index. Shahrekord University of Medical Sciences Journal, 6(3):33-38. In Farsi.

Ebrahimzadeh Mousavi, G., Rahmati Holasoo, H. and Taheri Mirghaed, A. 2013. Gill parasites of gold fish *Carassius auratus* imported into Iran. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Ebrahimzadeh Mousavi, H. and Rahmati Holasoo, H. 2013. Study of *Argulus* spp. Infestation in gold fish *Carassius auratus* (Linnaeus, 1758) in Iran. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Ebrahimzadeh Mousavi, H. A. 2000. Occurrence of *Vibrio parahaemolyticus* in freshwater fish farms (Iran). The Third World Fisheries Congress, Beijing, 31 Oct - 3 Nov 2000 (title).

Ebrahimzadeh Mousavi, H. A., Behtash, F., Rostami-Bashman, M., Mirzagar, S. S., Shayan, P. and Rahmati-Holasoo, H. 2011. Study of *Argulus* spp. infestation rate in goldfish, *Carassius auratus* (Linnaeus, 1758) in Iran. Human & Veterinary Medicine, International Journal of the Bioflux Society, 3(3):198-204.

Ebrahimzadeh Mousavi, H. A. and Khosravi, A. R. 2001. Isolation of toxigenic fungi at cyprinids farms in northern Iran. Journal of the Faculty of Veterinary Medicine, University of Tehran, 56(3):47-49. In Farsi.

Ebrahimzadeh Mousavi, H. A. and Khosravi, A. R. 2002. Isolation of toxigenic fungi at cyprinids farms in Northern Iran, p. 222. In: Aquaculture Europe - 2002, "Seafarming today and tomorrow", October 16-19, 2002, Trieste.

Ebrahimzadeh Mousavi, H. A. and Khosravi, A. R. 2004. Report of suspected epizootic ulcerative syndrome in goldfish (*Carassius auratus*). Journal of the Faculty of Veterinary Medicine, University of Tehran, 59(1):29-31. In Farsi.

Ebrahimzadeh Mousavi, H. A., Khosravi, A. R. and Azari Takami, G. 2000. A survey of fungal flora of cultivated cyprinids in Sefid Rood Fish Farmed Center. Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(3):57-60. In Farsi.

Ebrahimzadeh Mousavi, H. A., Khosravi, A. R., Firouzbakhsh, F., Mokhayer, B., Sasani, F., Mirzagar, S. S. and Rostami, M. 2005. A case report of Branchiomyces infection in common carp (*Cyprinus carpio*) from Iran. Iranian Journal of Fisheries Sciences, 5(1):105-112.

Ebrahimzadeh Mousavi, H. A., Soltani, M., Shayan, P., Ebrahimzadeh, E. and Hoseini, M. 2012. Identification of *Gyrodactylus gurleyi* in *Carassius auratus* using morphometric and molecular characterization. Iranian Journal of Veterinary Medicine, 6(1):41-46. In Farsi.

Edmondson, J. R. and Lack, H. W. 2006. Karl Georg Theodor Kotschy's itinerary in southern Iran, 1841-42. Willdenowia, 36(1):579-588.

Edwards, M. 1971. Water from the desert's bed. The qanats of Iran. Country Life, 149(3849):612-614.

Edwards, M. 1994. Pollution in the former U.S.S.R. Lethal legacy. National Geographic, 186(2):70-99.

Efati Abbasli Keshi, M., Bahr Kazemi, M. and Saeidi, A. A. 2014. A survey of effects of four anastasian (*sic*) extracts of clove flower, oregano, lidocaine and sodium bicarbonate on blood factors and cortisol hormone in silver carp (*sic*) (*Hypophthalmichthys nobilis*). Breeding and Aquaculture Sciences Quarterly, 2(3):37-46. In Farsi.

Egdery, M., Patimar, R., Eagderi, S., Golzarianpour, K. and Yelghi, S. 2014a. Study of allometric growth pattern in the Caspian roach during early development (up to 80 D pH). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Egdery, M., Patimar, R., Eagderi, S., Golzarianpour, K. and Yelghi, S. 2014b. Morphological development of roach fish (*Rutilus rutilus caspicus*) in the early stages of life (the time to 80 days after hatching). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Egglishaw, H. J. 1980. Benthic invertebrates of streams on the Alburz Mountain range near Tehran, Iran. Hydrobiologia, 69(1-2):49-55.

Eghisad, H., Barghi, H., Dehghani, A. and Saeidi Rad, M. 2019. Evaluation of environmental impacts of dams on rural areas (case study: Karun III Dam). Environmental Researches, 10(19):129-145. In Farsi.

Ehlers, E. 1971. Südkaspisches Tiefland (Nordiran) und Kaspisches Meer. Beiträge zu ihrer Entwicklungsgeschichte im Jung- und Postpleistozän. Tübinger Geographische Studien, 44(5):184 pp., 29 fotos.

Ehlers, E. 1980. Iran Grundzüge einer Geographischen Landeskunde. Wissenschaftliche Buchgesellschaft, Darmstadt, 18:xxxii + 596 pp., 11 Karten, 8 Bildtaf.

Ehsanfar, A., Bozorgnia, A., Barzegar, M. and Sadeghloo, A. 2021. Investigation on the prevalence and intensity of protozoan and metazoan parasites of some warm-water cultured fish species in Mazandaran province. New Technologies in Aquaculture Development (Journal of Fisheries), 14(4):16-28. In Farsi.

Ehsani, A., Hashemi, M., Afshari, A., Aminzare, M., Raeisi, M. and Tayebeh, Z. 2020. Effect of different types of active biodegradable films containing lactoperoxidase system or sage essential oil on shelf life of fish burger during refrigerated storage. LWT – Food Science and Technology, 117:108633.

Ehsani Kenari, J., Esmaeili Fereidouni, A. and Farokhrouz Lashidani, M. 2015. Effects of transportation on stress indicators, steroids hormones and hematological parameters of the broodstocks of common carp (*Cyprinus carpio*). Journal of Experimental Animal Biology, 4(1):53-65. In Farsi.

Eichwald, E. 1838. Faunae Caspii Maris Primitiae. Byulleten' Moskovskogo Obshchestva Ispytatelei Prirody, 11:125-174. In Latin.

Eichwald, E. 1841. Fauna caspio-caucasia nonnullis observationibus novis. IV. De Piscibus, pp. 163-220, XXXII-XXXV. Petropoli. iv + 233 pp. In Latin.

Eimanifar, A. and Mohebbi, F. 2007. Urmia Lake (Northwest Iran): a brief review. Saline Systems, 3:8 pp.

Einollahi, E., Hamidi, P., Einollahi, G. and Rahimi Bashar, M. R. 2012. Polycyclic aromatic hydrocarbons study in lipophilic and liver tissue of Rutilus frisii kutum of Nowshahr oil jetty, Caspian Sea. Ecology, Environment and Conservation, 18(4):1035-1039.

Eiselt, J. 1971. Forschungsarbeit des Naturhistorischen Museums Wien im und für den Iran. Österreiche Zeitschrift für Kultur, Politik und Wirtschaft des Islamischer Länder, 11-12(4):29-33.

Ejraei, F., Khara, H., Ghiasi, M., Nezami, Sh. A. and Bavand Savadkohi, E. 2013. Effect of age on some hematological and biological serum parameters in grass carp (*Ctenopharyngodon idella*). Journal of Fisheries, 7(2):7-14. In Farsi.

Ekman, S. 1953. Zoogeography of the Sea. Sidgwick and Jackson, London. xiv + 417 pp.

Ekmekci, F. G. 1996. Growth properties of carp (*Cyprinus carpio* L., 1758) population in Sariyar Dam Lake (Ankara). Turkish Journal of Zoology, 20(Supplement):107-115.

Ekmekçi, F. G. and Banarescu, P. 1998. A revision of the generic position of *Barynotus* (*Systomus*) *verhoeffi*, and the validity of the genera *Carasobarbus*, *Kosswigobarbus* and *Mesopotamichthys* (Pisces, Cyprinidae). Folia Zoologica, Brno, 47(supplement 1):87-96.

Elahi Moghaddam, E., Soltani, M., Nokhbe Zare, D., Ghafari, M. and Naderi, M. 2014. Study of parasites in skin and gill of (*Schizothorax zarudnyi*) in Sistan region. Journal of Aquatic Animals and Fisheries, 5(18):1-11. In Farsi.

Elahimanesh, P. 2001. Fisheries of Iran in the 3rd millennium. 131st American Fisheries Society Annual Meeting, Phoenix, Arizona, 19-23 August 2001 (abstract).

Elanidze, M., Demetrashvili, M., Burchuladze, O. and Kurashvili, B. 1970. Ryby Presnykh vod Gruzii Atlas [Atlas of the freshwater fishes of Georgia]. Akademiya Nauk Gruzinskoi SSR, Institut Zoologii, Tbilisi. 115 pp. In Russian and Georgian.

Elanidze, R. F. 1983. Ikhtiofauna rek i ozer Gruzii [Ichthyofauna of the rivers and lakes of Georgia]. Akademiya Nauk Gruzinskoi SSR, Institut Zoologii “Metsniereba”, Tbilisi. 319 pp., map.

Elhaghi, K., Rezaei Tavabe, K., Rafiee, G., Mirvaghefi, A. and Javanshir, Khoie, A. 2017. Investigation of effects of different concentrations of treated wastewater effluent on blood biochemical factors, cortisol level, liver and gill tissues of silver carp (*Hypophthalmichthys molitrix*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(1):11-25. In Farsi.

El Kholy, F. H. 1952. Hydrology of River Tigris. Directorate General of Irrigation, Iraq. 183 pp., map.

Elliot, G. F. 1977. Untitled letter on Kurdistan fishes. Proceedings of the Geological Association, 87(4):430.

Elmi, A. M., Abdoli, A., Khorasani, N., Yousefi Siahkalroodi, S. 2012. Identification and diversity of Sarbaz River fishes (Sistan & Baluchestan Province). Journal of Animal Environment, 3(3):11-18. In Farsi.

Elmi, F., Chenarian Nakhaei, R. and Alinezhad, H. 2018. Conversion of fisheries waste as magnetic hydroxyapatite bionanocomposite for the removal of heavy metals from groundwater. Water Supply, 18(4):1406-1419.

Elmizadeh, H., Farhadi, S. and Razmi, M. 2017. Estimates of heavy metals pollution in Parishan Wetland sediments using pollution indices. Environmental Sciences, 15(1):61-76. In Farsi.

Elp, M., Osmanoğlu, M. I., Kadak, A. E. and Turan, D. 2018. Characteristics of *Capoeta oguzelii*, a new species of cyprinid fish from the Ezine Stream, Black Sea basin, Turkey (Teleostei: Cyprinidae). Zoology in the Middle East, 64(2):102-111.

Elp, M., Şen, F. and Özuluğ, M. 2015. *Alburnus selcuklui*, a new species of cyprinid fish from East Anatolia, Turkey (Teleostei: Cyprinidae). Turkish Journal of Fisheries and Aquatic Sciences, 15(1):181-186.

Elsagh, A. 2010. Determination of heavy metals in *Rutilus frisii kutum* and *Cyprinus carpio* of Caspian Sea. Journal of Marine Science and Technology Research, 5(2):69-77. In Farsi.

Elsagh, A. 2011. Determination of some heavy metals in *Rutilus frisii kutum* and *Cyprinus carpio* fillet from south Caspian Sea. Veterinary Journal (Pajouhesh va Sazandegi), 24(4)(89):33-44. In Farsi.

Elsagh, A. 2012. Determination of zinc, copper, cobalt and manganese intensity in *Rutilus frisii*

kutum and *Cyprinus carpio* fishes of Caspian Sea. Journal of Gorgan University of Medical Science, 13(4):107-113. In Farsi.

Elvira, B. 1986. Revisión taxonómica y distribución geográfica del género *Chondrostoma* Agassiz, 1835 (Pisces, Cyprinidae). Tesis Doctorales, Instituto Nacional de Investigaciones Agrarias, Madrid. 530 pp.

Elvira, B. 1988. Taxonomic revision of the genus *Chondrostoma* Agassiz, 1835 (Pisces, Cyprinidae). Cybium, 11(2)(1987):111-140.

Elvira, B. 1991. Further studies on the taxonomy of the genus *Chondrostoma* (Osteichthyes, Cyprinidae): species from eastern Europe. Cybium, 15(2):147-150.

Elvira, B. 1997. Taxonomy of the genus *Chondrostoma* (Osteichthyes, Cyprinidae): an updated review. Folia Zoologica, Brno, 46(Supplement 1):1-14.

Elyasi, H., Rahimibashar, M. R. and Vahabzadeh, H. 2015. Effect of density and food regime on growth, survival and body composition of bighead (*Hypophthalmichthys nobilis*) larvae. Journal of Aquaculture Development, 9(2):1-11. In Farsi.

Emadi, H. 1979. The state of the fishing and reproduction of the kutum, Rutilus frisii kutum, in the Caspian Sea of Iran. Journal of Ichthyology, 19(4):151-154.

Emadi, H. 1985. Victims of kutum management weakness. Fish Magazine, 7:40-46. In Farsi.

Emadi, H. 1990. Aquaculture in Iran. In: World Aquaculture 90, Halifax, N.S., Canada, 10-14 June 1990 (abstract).

Emadi, H. 1993a. The status of aquaculture in Iran. Abzeeyan, Tehran, 4(2):VII-IIX. In English.

Emadi, H. 1993b. Nutrient requirements of warm water fishes. Abzeeyan, Tehran, 4(4):2-7, II. In Farsi.

Emadi, H., Hosseinzadeh Sahafi, H., Pori, T. and Amaninejad, P. 2014. Comparison between the stimulating effect of LHRH-A_3 and LHRH-A_2 on reproductive responding of brood stocks, fertilization and survival percentage in *Hypophthalmichthys molitrix*. Journal of Aquaculture Development, 8(1):61-71. In Farsi.

Emamgholizadeh, S. 2008. Water quality assessment of the Kopal River (IRAN). International Meeting on Soil Fertility Land Management and Agroclimatology, Turkey, pp. 827-837.

Emami, R. and Hosseini, S. J. F. 2004. Assessing the factors that affect the participation of fishery cooperatives in city of Sari in protecting the fish reserves in Caspian Sea. Journal of Agricultural Sciences, 9(4):93-116. In Farsi.

Enayat Gholampoor, T. and Imanpoor, M., R. 2012. The relationship between female broodstocks gonadal characteristic, size and hepatosomatic index of common carp (*Cyprinus carpio* Linnaeus, 1758) in Gorgan Bay. Iranian Journal of Biology, 25(3):409-417. In Farsi.

Enayat Gholampoor, T., Imanpoor, M. R., Hosseini, S. A. and Shabanpoor, B. 2011. Effect of different levels of salinity on growth indices, survival rate, food consumption and blood parameters in *Rutilus frisii kutum* (Kamensky, 1901) fingerlings. Iranian Journal of Biology, 24(4):539-548.

Enayat Gholampoor, T., Imanpoor, M. R., Shabanpoor, B. and Hosseini, S. A. 2011. The study of growth performance, body composition and some blood parameters of *Rutilus frisii kutum* (Kamenskii, 1901) fingerlings at different salinities. Journal of Agricultural Science and Technology, 13(6):869-876.

English, P. W. 1966. City and village in Iran: Settlement and economy in the Kirman Basin. The University of Wisconsin Press, Madison. xx + 204 pp.

English, P. W. 1968. The origin and spread of qanats in the Old World. Proceedings of the

American Philosophical Society, 112(3):170-181.
English, P. W. 1998. Qanats and lifeworlds in Iranian Plateau villages. Yale School of Forestry & Environment Studies Bulletin Series, 103:187-205.
Epler, P., Bartel, R., Chyb, J. and Szczerbowski, J. A. 2001. Diet of selected fish species from the Iraqi lakes Tharthar, Habbaniya and Razzazah. Archives of Polish Fisheries, 9(supplement 1):211-223.
Epler, P., Bartel, R., Szczerbowksi, J. A. and Szypuła, J. 2001. The ichthyofauna of lakes Habbaniya, Tharthar and Razzazah. Archives of Polish Fisheries, 9(supplement 1):171-184.
Epler, P., Sokołowska-Mikołajczyk, M., Popek, W., Bieniarz, K., Bartel, R. and Szczerbowski, J. A. 2001. Reproductive biology of selected fish species from lakes Tharthar and Habbaniya in Iraq. Archives of Polish Fisheries, 9(supplement 1):199-209.
Epler, P., Sokołowska-Mikołajczyk, M., Popek, W., Bieniarz, K., Kime, D. E. and Bartel, R. 1996. Gonadal development and spawning of *Barbus sharpei* (*sic*), *Barbus luteus* and *Mugil hishni* in fresh and saltwater lakes of Iraq. Archiwum Rybactwa Polskiego, 4(1):113-124.
Erfani Majd, N., Mesbah, M. and Esfandiari, K. 2014. Histometrical and histochemical studies of alarm mucous cells in different regions of mature male and female epidermis of silver carp (*Hypophthalmichthys molitrix*). Journal of Animal Environment, 6(3):37-43. In Farsi.
Erfani Majd, N., Mesbah, M. and Seyedi, S. 2015. Histomorphometrical study of silver carp (*Hypophthalmichthys molitrix*) fish testis in two age classes. Iranian Scientific Fisheries Journal, 23(4):61-72, 62. In Farsi.
Erfani Majd, N., Mesbah, M. and Rahimi Zarneh, S. 2015. Histomorphological study on silver carp ovary in two age groups. Journal of Veterinary Research, 70(2):203-211. In Farsi.
Erfani Majd, N. and Rahdar, S. 2017. Histomorphometrical studies of alarm cells in different parts of female carp fish skin (common carp) in reproductive and non-reproductive seasons. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 810-816. In Farsi.
Erfani Majid, N., Salamat, N. and Hashemi Tabar, M. 2009. Evaluation of incubated carp ovarian follicles response (*Cyprinus carpio*) to carp pituitary extract (CPE) and cultivated pituitary cells secretion (CPS) in vitro. Iranian Veterinary Journal, 5(3)(24):24-30. In Farsi.
Ergene, S. 1993. Karasu'da Yaşayan *Chalcalburnus mossulensis* (Heckel, 1843), (Pisces, Cyprinidae)'in Büyüme Oranları[The growth rates of *Chalcalburnus mossulensis* (Heckel, 1843), (Pisces, Cyprinidae) in Karasu]. Turkish Journal of Zoology, 17(4):367-377.
Ergene Gözükara, S. and Çavaş, T. 2004. A karyological analysis of *Garra rufa* (Heckel, 1843) (Pisces, Cyprinidae) from the eastern Mediterranean River basin in Turkey. Turkish Journal of Veterinary and Animal Sciences, 28(3):497-500.
Ergens, R. and Gusev, A. V. 1965. *Dactylogyrus prostae* Molnár, 1964 (Monogenoidea) aus den Kiemen von *Leuciscus cephalus* (L.) und *Leuciscus cephalus orientalis* Nordmann. Ceskoslovenská Parazitologie, 12:323-325.
Erk'akan, F., Innal, D. and Özdemir, F. 2014. Length-weight relationships for five cyprinid species in Turkey. Journal of Applied Ichthyology, 30(1):212-213.
ERM-Lahmeyer International GmbH, DHI Water & Environment and GOPA Consultants.

2001a. State and Challenges of the Marine and Coastal Environment of the Caspian Sea (Transboundary Diagnostic Analysis). Caspian Environment Programme: Phase 2, European Tacis Programme. 162 pp., annexes A and B.

ERM-Lahmeyer International GmbH, DHI Water & Environment and GOPA Consultants. 2001b. Proposals for Establishment of a Caspian Fisheries Commission. Caspian Environment Programme: Phase 2, European Tacis Programme. 56 pp.

Ermakov, O. A., Levina, M. A., Titov, S. V. and Levin, B. A. 2017. mtDNA-based identification of two widespread roach species (*Rutilus*, Cyprinidae) characterized by sympatric zone. Inland Water Biology 10(1):112-114.

Ershad Langroudi, H. 2004. Evaluation and comparison of durability of polycyclic aromatic hydrocarbon compounds (PAHs) and its relation to the lipid content in smoked fishes, Silver carp (*Hypophthalmichthys molitrix*), *Rutilus frisii kutum* and Herring (*Alosa caspia*). Ph.D. Thesis, Islamic Azad University, Science and Research Branch, Tehran. 123 pp. In Farsi.

Ershad Langroudi, H., Rahimibashar, M. R., Tagheipour Kouhbane, S. and Farshehi, M. 2017. Investigation of diet of fishes (*Silurus glanis*) in Bojagh Wetland of Kiashahr. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Ershad Langroudi, H. and Tagheipour Kouhbane, S. 2017. Investigating the biological characters and estimated of meet (*sic*) quality for hamry (*Carasobarbus luteus*) in the Karoon River (Khuzestan province). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Eschmeyer, W. N. 1990. Catalog of the Genera of Recent Fishes. California Academy of Sciences, San Francisco. 697 pp.

Eschmeyer, W. N. (Ed.). 1998. Catalog of Fishes. California Academy of Sciences, San Francisco. 3 volumes, CD-ROM.

Eschmeyer, W. N., Ferraris, C. J., Hoang, M. D. and Long, D. J. 1996. A Catalog of the Species of Fishes. Preliminary version (Sept. 1996). www.calacademy.org/research/ichthyology/species.

Eschmeyer, W. N. and Fong, J. D. 2011. Pisces. In: Zhang, Z.-Q. (Ed.). Animal biodiversity: An outline of higher level classification and survey of taxonomic richness. Zootaxa, 3148:26-38.

Esfandiar, F., Firouzbaksh, F., Rahmani, H. and Janekhalili, K. 2015b. Sub-lethal concentrations effects of chlorpyrifus (*sic*) on blood biochemical parameters and serum enzymes activity in common carp (*Cyprinus carpio*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 134-135.

Esfandiar, F., Forouzbaksh, F., Rahmani, H. and Janekhalili, K. 2015a. Effect of acute toxicity of chlorpyrifos on hematological parameters in common carp (*Cyprinus carpio*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 32-33.

Esfandyar, F., Firouzbakhsh, F., Rahmani, H. and Jani-Khalili, K. 2016. The effects of sublethal concentrations of chlorpyrifos on the liver enzyme activities and oxidative stress markers in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(3):229-307. In Farsi.

Esfandyari, M., Golpour, A., Dadras, H. and Rahbar, M. 2012. Effect of ovarian fluid characteristics on sperm motility in *Rutilus frisii kutum*. World Aquaculture Society,

AQUA 2012, 1-5 September, Prague, Czech Republic (abstract).
Eskandari, Gh., Dehghan, S. and Nikpay, M. 2004. The reproduction biology of *Barbus esocinus* in Dez Dam reservoir. Iranian Scientific Fisheries Journal, 13(1):1-24. In Farsi.
Eskandari, Gh., Sabz Alizadeh, S., Dehgan Madiseh, S. and Mayahi, Y. 2007. Fish populations structures in the Dez Dam Lake. Pajouhesh va Sazandegi, 19(1)(74):123-129. In Farsi.
Eskandari, Gh., Safeikhani, H., Dehghan, S. and Esmaeli, F. 2003. Fecundity and feeding of *Barbus xanthopterus* in Karkheh River and Hoor-al-Azim Marsh. Iranian Scientific Fisheries Journal, 12(1):21-42, 2. In Farsi.
Eskandari, Gh., Safikhani, H., Dehghan, S., Esmaeily, F. and Amiriney, A. S. 2000. Abundance, spawning season and type of gattan (*Barbus xanthopterus* Heckel, 1843) in south of Karkheh River and Hour-al-Azim Marsh (Khouzestan Province). Iranian Scientific Fisheries Journal, 9(2):1-26. In Farsi.
Eskandari, S., Hosseini, H., Hosseini, S. E. and Shiraei Kasmaei, A. 2013. Antioxidant and antibacterial effects of parsley extract (*Petroselinum crispum*) on silver carp (*Hypophthalmichthys molitrix*) fillets during refrigeration. Journal of Nutrition Sciences and Food Technology, 8(2):165-172. In Farsi.
Eskandari, S. and Zeraatkish, S. Y. 2016. Study of value added and fishery export on economic variables agriculture Iran. Journal of Aquaculture Development, 10(3):1-12. In Farsi.
Eskandary, Gh., Safeikhani, H. and Ghofleh Maramazi, J. 1999. Ichthyofauna and some biological indices in Karoon, Dez and Bahmanshir rivers (southwest of Iran). Iranian Scientific Fisheries Journal, 8(3):23-36, 2-3. In Farsi.
Eslami, A. and Kohneshahri, M. 1978. Study on helminthiasis of *Rutilus frisii katum* (*sic*) from the south Caspian Sea. Acta Zoologica et Pathologica Antverpiensia, 70:153-155.
Eslami, A. and Mokhayer, B. 1977. Nematode larvae of medical importance found in market fish in Iran. Pahlavi Medical Journal, 8(3):345-348.
Eslami, A. H. and Anwar, M. 1971. Occurrence and intensity of the infestation by *Caryophyllaeus fimbriceps* in carp and mullet (new host) in Iran. Rivista italiana di Piscicoltura e Ittiopatologia, 6(1):21-24.
Eslami, F., Pourang, N., Nasrolazadeh Saravi, H., Fazli, H., Roohi, A. and Roshantabari, M. 2015. Quantitative assessment of the impact of *Mnemiopsis leidyi* on the southern Caspian zooplankton structure during 1996-2010. Iranian Scientific Fisheries Journal, 24(1):47-59. In Farsi.
Eslami, S., Hajizadeh Moghaddam, A., Jafari, N., Nabavi, S. F., Nabavi, S. M. and Ebrahimzadeh, M. A. 2011. Trace element level in different tissues of *Rutilus frisii kutum* collected from Tajan River, Iran. Biological Trace Element Research, 143(2):965-973.
Eslami, V., Sattari, M., Imanpour Namin, J. and Ashrafi, S. D. 2014. Concentration of heavy metals (Pb, Cd) in muscle and liver of *Perca fluviatilis* and *Tinca tinca* in Anzali Wetland, southwest the Caspian Sea. International Journal of Aquatic Biology, 2(6):319-324.
Eslamizadeh, E. and Qaeni, M. 2017. The effect of complementary biofuel complement assistance in the production of hydrophobic fish. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 144-148. In Farsi.
Eslamloo, K., Akhavan, S. R., Eslamifar, A. and Henry, M. A. 2015. Effects of background colour on growth performance, skin pigmentation, physiological condition and innate immune responses of goldfish, *Carassius auratus*. Aquaculture Research, 46(1):202-215.

Eslamloo, K., Akhavan, S. R., Jamalzad Fallah, F. and Henry, M. A. 2014. Variations of physiological and innate immunological responses in goldfish (*Carassius auratus*) subjected to recurrent acute stress. Fish and Shellfish Immunology, 37(1):147-153.

Esmaeilbeigi, M. and Kalbassi, M. R. 2015a. Optimization of single-cell gel electrophoresis (SCGE) or comet assay for study of DNA damage to liver cells in Caspian kutum (*Rutilus frissi* (*sic*) *kutum*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 239.

Esmaeilbeigi, M. and Kalbassi, M. R. 2015b. Alkaline comet assay to study DNA damage optimize sperm cells goldfish *Carassius auratus*. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 240.

Esmaeilbeigi, M., Kalbassi, M. R., Seyedi, J., Behzadi Tayemeh, M. and Amiri Moghaddam, J. 2021. Intra and extracellular effects of benzo [α] pyrene on liver, gill and blood of Caspian White fish (*Rutilus frissi kutum*) (*sic*): Cyto-genotoxicity and histopathology approach. Marine Pollution Bulletin, 163:11942.

Esmaeili A., Farshchi, P. and Darvishi, F. 2003. The impacts of *Mnemiopsis leidyi*'s invasion in the Caspian Sea. Journal of Environmental Science and Technology, 2003(18):35-53. In Farsi.

Esmaeili, F., Sharifpour, I. and Soltani, M. 2005. Isolation and identification of *Flavobacterium columnaris*-like organisms from grass carp (*Ctenopharyngodon idella*) and assessment of its histo-pathological effects in Khouzestan Province, southern Iran. Iranian Scientific Fisheries Journal, 14(2):1-12. In Farsi.

Esmaeili, H. R. 2006. Freshwater fish diversity in the Gulf drainage basins of Iran. The 1st International Conference on the State of the Gulf Ecosystem: Future and Trends. 5-7 March 2006, Rotana Hotel, Al Ain, United Arab Emirates University (abstract).

Esmaeili, H. R. 2021. Checklist of freshwater fishes of southwestern wetlands of Iran, pp. 295-318. In: Jawad, L. A. (Ed.). 2021. Southern Iraq's Marshes - Their Environment and Conservation. Springer, Coastal Research Library, 36:xxiii + 815 pp.

Esmaeili, H. R. and Abbasi, K. 2021. Checklist of fishes of the Caspian Sea basin: land of wetlands, pp. 319-349. In: Jawad, L. A. (Ed.). 2021. Southern Iraq's Marshes - Their Environment and Conservation. Springer, Coastal Research Library, 36:xxiii + 815 pp.

Esmaeili, H. R., Ansari, T. H. and Teimory, A. 2007. Scale structure of a cyprinid fish, *Capoeta damascina* (Valenciennes in Cuvier and Valenciennes, 1842) using scanning electron microscope (SEM). Iranian Journal of Science and Technology, Transaction A, 31(A3):255-262.

Esmaeili, H. R., Babai, S., Gholamifard, A., Pazira, A., Gholamhosseini, A. and Coad, B. W. 2015. Fishes of the Persis region of Iran: an updated checklist and ichthyogeography. Iranian Journal of Ichthyology, 2(3):201-223.

Esmaeili, H. R., Babai, S. and Pazira, A. 2013. Inland fishes of Bushher province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 9 (abstract).

Esmaeili, H. R., Choobineh, R., Zareian, H. and Gholamhosseini, A. 2017. Life history traits and gonad histology of an endemic cyprinid fish, Mond spotted barb, *Capoeta mandica* from southern Iran. Caspian Journal of Environmental Sciences, 15(2):97-112.

Esmaeili, H. R., Coad, B. W., Gholamifard, A., Nazari, N. and Teimory, A. 2011. Annotated checklist of the freshwater fishes of Iran. Zoosystematica Rossica, 19(2)(2010):361-386.

Esmaeili, H. R., Coad, B. W., Mehraban, H. R., Masoudi, M., Khaefi, R., Abbasi, K., Mostafavi,

H. and Vatandoust, S. 2014. An updated checklist of fishes of the Caspian Sea basin of Iran with a note on their zoogeography. Iranian Journal of Ichthyology, 1(3):152-184.

Esmaeili, H. R., Coad, B. W., Teimori, A. and Gholamifard, A. 2011. Freshwater ichthyodiversity and its conservation in Iran. 6th International Symposium on Ecology and Environmental Problems, 17-20 November 2011, Antalya, Turkey (poster).

Esmaeili, H. R. and Ebrahimi, M. 2006. Length-weight relationships of some freshwater fishes of Iran. Journal of Applied Ichthyology, 22(4):328-329.

Esmaeili, H. R., Ebrahimi, M., Ansari, T. H., Teimory, A. and Gholamhosseini, G. 2009. Karyotype analysis of Persian stone lapper, *Garra persica* Berg, 1913 (Actinopterygii: Cyprinidae) from Iran. Current Science, 96(7):959-962.

Esmaeili, H. R. and Farhadi, T. 2004. Study of four populations of *Garra rufa* (Heckel, 1843) (Cyprinidae, Garrinae) in Fars province, Iran. Proceedings of the 12th Iranian Biology Conference, Bu Ali University, Hamadan. p. 37 (abstract).

Esmaeili, H. R., Gholamhosseini, A., Mohammadian-kalat, T. and Aliabadian, M. 2018. Predicted changes in climatic niche of *Alburnus* species (Teleostei: Cyprinidae) in Iran until 2050. Turkish Journal of Fisheries and Aquatic Sciences, 18(8):995-1003.

Esmaeili, H. R. and Gholami, Z. 2009. Scanning electron microscopy of scales in cyprinid fish, *Alburnoides bipunctatus* (Blotch (*sic*), 1782). Ferdowsi University International Journal of Biological Sciences, 1(1):19-27.

Esmaeili, H. R. and Gholami, Z. 2011. Scanning electron microscopy of the scale morphology in cyprinid fish, *Rutilus frisii kutum* Kamenskii, 1901 (Actinopterygii: Cyprinidae). Iranian Journal of Fisheries Sciences, 10(1):155-166.

Esmaeili, H. R., Gholami, Z., Hojat Ansari, T. and Baghbani, S. 2009-2010. Morphology of otoliths in some fishes of Caspian Sea basin. Journal of Applied Biology, 22(1):18-27. In Farsi.

Esmaeili, H. R., Gholami, Z., Teimory, A. and Baghban, S. 2010. Morphology of urohyal bone and its importance in taxonomy of some fishes of the south basin of Caspian Sea. Iranian Journal of Biology, 23(3):448-459. In Farsi.

Esmaeili, H. R. and Gholamifard, A. 2011. Range extension and translocation for *Hemiculter leucisculus* (Basilewsky, 1855) (Cyprinidae) in western and northwestern Iran. Journal of Applied Ichthyology, 27(6):1394-1395.

Esmaeili, H. R. and Gholamifard, A. 2012. Ultrastructure of the chorion and the micropyle of an endemic cyprinid fish, *Cyprinion tenuiradius* Heckel, 1849 (Teleostei: Cyprinidae) from southern Iran. Iranian Journal of Fisheries Sciences, 11(3):657-665.

Esmaeili, H. R., Gholamifard, A. and Freyhof, J. 2011. Ichthyofauna of Zarivar Lake (Iran) with the first records of *Hemiculter leucisculus* and *Alburnus hohenackeri* in the Tigris drainage. Electronic Journal of Ichthyology, 7(1):1-6.

Esmaeili, H. R., Gholamifard, A. and Gholamhosseini, A. 2010. Ichthyofauna of Iranian part of Tigris River basin. 16th National and 4th International Conference of Biology, Ferdowsi University of Mashhad, Mashhad, Iran, 14-16 September 2010 (abstract).

Esmaeili, H. R., Gholamifard, A., Vatandoust, S., Sayyadzadeh, G., Zare, R. and Babaei, S. 2014. Length-weight relationships for 37 freshwater fish species of Iran. Journal of Applied Ichthyology, 30(5):1073-1076.

Esmaeili, H. R., Gholamifard, A., Zarei, N. and Arshadi, A. 2010. Scale structure of *Garra rossica* (Nikolskii, 1900) using scanning electron microscope. 16th National and 4th International Conference of Biology, Ferdowsi University of Mashhad, Mashhad, Iran,

14-16 September 2010 (abstract).
Esmaeili, H. R., Gholamifard, A., Zarei, N. and Arshadi, A. 2012. Scale structure of a cyprinid fish, *Garra Rossica* (*sic*) (Nikol'skii, 1900) using scanning electron microscope (SEM). Iranian Journal of Science and Technology, Transaction A, 36(A4):487-492.
Esmaeili, H. R., Hagmoradlo, A. and Niksirat, H. 2003. Exotic fishes of Iran with special reference to Gasterosteus aculeatus. World Aquaculture 2003, 20-23 May, Salvador, Brazil (title).
Esmaeili, H. R., Hojat Ansari, T. and Teimory, A. 2007. Scale structure of a cyprinid fish, *Capoeta damascina* (Valenciennes in Cuvier and Valenciennes, 1842) using scanning electron microscope (SEM). Iranian Journal of Science and Technology, Transaction A, 31(A3):255-262.
Esmaeili, H. R., Khaefi, R. and Zammanian Nejad, R. 2016. Historical review on the taxonomy of *Squalius berak* Heckel, 1843 (Teleostei: Cyprinidae). FishTaxa, 1(3):118-126.
Esmaeili, H. R., Khajepanah, A., Mehraban, H., Elmi, A., Malekzehi, H. and Pazira, A. 2015. Fishes of the Mashkid and Makran basins of Iran: an updated checklist and ichthyogeography. Iranian Journal of Ichthyology, 2(2):113-132.
Esmaeili, H. R., Malekzehi, H., Pazira, A. and Freyhof, J. 2013a. First record of the Kalabans, *Bangana dero* (Hamilton, 1822), from Iran (Teleostei: Cyprinidae). Zoology in the Middle East, 59(1):89-91.
Esmaeili, H. R., Malekzehi, H., Pazira, A. and Freyhof, J. 2013b. First record of the Kalabans, (Cyprinidae: *Bangana dero*), from Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 8 (abstract).
Esmaeili, H. R., Mehraban, H., Abbasi, K., Eagderi, S., Keivany, Y. and Coad, B. W. 2017. Review and updated checklist of freshwater fishes of Iran: Taxonomy, distribution and conservation status. Iranian Journal of Ichthyology, 4(Supplement 1):1-114.
Esmaeili, H. R., Nazari, N., Gholamifard, A., Gholamhosseini, Gh., Teimory, A. and Coad, B. W. 2011. Range extension and translocation for *Rhodeus amarus* (Bloch, 1782) (Actinopterygii: Cyprinidae) in northwest Iran. Turkish Journal of Zoology, 35(6):883-886.
Esmaeili, H. R., Nazari, N., Saifali, M. and Gholamhosseini, A. 2011. Morphometric and meristic comparisons of populations of qanat tailor fish *Alburnoides qanati* Coad & Bogutskaya, 2009 (Actinopterygii: Cyprinidae) in Kor River basin Iran. Iranian Journal of Animal Biosystematics, 7(1):1-11.
Esmaeili, H. R. and Piravar, Z. 2005. First report of karyotype of Persian chub, *Petroleuciscus persidis* (Coad, 1981) (Actinopterygii: Cyprinidae) from southern Iran. 13th Iranian Biology Conference and the First International Conference of Biology, 23-25 August 2005, Gilan University, Rasht (abstract).
Esmaeili, H. R. and Piravar, Z. 2006a. Karyotype of Persian chub, *Petroleuciscus persidis* (Coad, 1981) (Actinopterygii: Cyprinidae) from southern Iran. Turkish Journal of Zoology, 30:1-3.
Esmaeili, H. R. and Piravar, Z. 2006b. On the karyotype of *Cyprinion tenuiradius* Heckel, 1849 (Pisces: Cyprinidae) from the southwest of Iran. Zoology in the Middle East, 39(1):75-80.
Esmaeili, H. R. and Piravar, Z. 2007. Karyotype analysis of *Garra rufa* (Heckel, 1843) (Actinopterygii: Cyprinidae) in Fars Province. Iranian Scientific Fisheries Journal, 16(3):11-18. In Farsi.

Esmaeili, H. R. and Sayyadzadeh, G. 2021. Endemic fishes of Iran: Diversity and conservation priorities. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Esmaeili, H. R., Sayyadzadeh, G., Coad, B. W. and Eagderi, S. 2016. Review of the genus *Garra* Hamilton, 1822 in Iran with description of new species: a morpho-molecular approach (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 3(2):82-121.

Esmaeili, H. R., Sayyadzadeh, G., Eagderi, S. and Abbasi, K. 2018. Checklist of freshwater fishes of Iran. FishTaxa, 3(3):1-95.

Esmaeili, H. R., Sayyadzadeh, G., Zarei, F., Kafaei, S. and Coad, B. W. 2020. Phylogeographic pattern and population structure of the Persian stone loach, *Oxynoemacheilus persa* (Heckel, 1847) (family: Nemacheilidae) in southern Iran with implications for conservation. Environmental Biology of Fishes, 103(1):77-88.

Esmaeili, H. R. and Teimori, A. 2005a. Morphology of urohyal bone and its importance in taxonomy of some freshwater fishes of Iran. 13th Iranian Biology Conference and the First International Conference of Biology, 23-25 August 2005, Guilan University, Rasht, Iran (poster).

Esmaeili, H. R. and Teimori, A. 2005b. Exotic and introduced fish species of Fars province in southern of Iran. First International Congress on Biological Science, Tehran, Karaj (poster).

Esmaeili, H. R. and Teimori, A. 2008. Exotic and introduced fish species of Iran and their impacts on native fishes. XX International Congress of Zoology, 26-29 August 2008, Paris (poster).

Esmaeili, H. R. and Teimori, A. 2009. Exotic and introduced fish species of Iran and their impact on native fishes. 13th European Congress of Ichthyology, 6-12 September 2009, Klaipeda, Lithuania (abstract).

Esmaeili, H. R. and Teimori, A. 2016. Fish species diversity of Fars. Fars Environment Department. 288 pp. In Farsi.

Esmaeili, H. R., Teimori, A. and Abdoli, A. 2015. Fish Diversity of Fars Province. MS, 257 pp. In Farsi.

Esmaeili, H. R., Teimori, A. and Dehghani, N. 2006.The qanat habitat as a fish refuge. Euro-Arab Conference and Exhibition on Environment, Kuwait, 27-29 November 2006, pp. 445-451.

Esmaeili, H. R., Teimori, A. and Gholamhosseini, G. 2007. Freshwater ichthyodiversity and its conservation in Iran. XII European Congress of Ichthyology, Cavtat (Dubrovnik), Croatia. pp. 200-201.

Esmaeili, H. R., Teimori, A., Owfi, F., Abbasi, K. and Coad, B. W. 2014. Alien and invasive freshwater fish species in Iran: Diversity, environmental impacts and management. Iranian Journal of Ichthyology, 1(2):61-72.

Esmaeili, H. R., Teimori, A., Owfi, F. and Coad, B. W. 2014. Freshwater invasive fish species in Iran: diversity, environmental impacts and management. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Esmaeili, H. R., Teimory, A. and Coad, B. W. 2008. Qanat systems as fish refuge. International Congress on Documenting, Analysing and Managing Biodiversity in the Middle East 20-23 October 2008, Intercontinental Hotel, Aqaba, Jordan (title).

Esmaeili, H. R., Teimory, A. and Dehgani, N. 2006. The qanat habitat as a fish refuge. Euro-Arab Conference and Exhibition on Environment, Kuwait, pp. 145-153.

Esmaeili, H. R., Teimory, A., Gholami, Z. and Hosseinie, F. 2006. Range extension of *Barbus sublimus* Coad and Najafpour, 1997 (Actinopterygii: Cyprinidae) and its sympatric species in southwest of Iran. Iranian Journal of Animal Biosystematics, 2(1):19-24.

Esmaeili, H. R., Teimory, A. and Khosravi, A. R. 2007. A note on biodiversity of Ghadamgah spring-stream system in Fars province, southwest Iran. Iranian Journal of Animal Biosystematics, 3(1):15-23.

Esmaeili, H. R., Teimory, A. and Piravar, Z. 2009. Otolith morphology of some freshwater fishes of Iran. Iranian Scientific Fisheries Journal, 17(4):163-168. In Farsi.

Esmaeili, H. R. and Timoorei, A. 2006. Morphology of urohyal bone and its importance in taxonomy of some freshwater fishes of Iran. Iranian Scientific Fisheries Journal, 15(3):1-8. In Farsi.

Esmaeili, H. R. and Yazdanpanah, M. 2004. Determination of spawning season of *Garra rufa* (Cyprinidae: Garrinae) based on three indices. 7th Asian Fisheries Forum, 30 November-4 December 2004, p. 60 (abstract).

Esmaeili, H. R., Yazdanpanah, M. and Monsefi, M. 2005a. Reproductive biology of doctor fish, *Garra rufa* (Cyprinidae: Garrinae), in southwest of Iran. Annual International Symposium of the Fisheries Society of the British Isles, 18-22 July 2005, University of Wales, Bangor (abstract).

Esmaeili, H. R., Yazdanpanah, M. and Monsefi, M. 2005b. Reproductive biology of doctor fish, *Garra rufa* (Cyprinidae: Garrinae), in southwest of Iran. Journal of Fish Biology, 67(Supplement B):282.

Esmaeili, H. R., Zareian, H., Eagderi, S. and Alwan, N. 2016. Review on the taxonomy of Tigris scraper, *Capoeta umbla* (Heckel, 1843) and its confirmation record from the Iranian part of Tigris River, Persian Gulf basin (Teleostei: Cyprinidae). FishTaxa, 1(1):35-44.

Esmaeili, H. R., Zareian, H., Gholamhosseini, A., Ebrahimi, M., Gholami, Z., Teimori, A. and Ansari, T. A. 2010. Karyotype analysis of the king nase fish, *Chondrostoma regium* (Heckel, 1843) (Actinopterygii: Cyprinidae) from Iran. Turkish Journal of Fisheries and Aquatic Sciences, 10(4):477-481.

Esmaeili, H. R. and Zeinai, A. R. 1998. Freshwater fishes of Hormozgan Province. 7th Conference of Iranian Biology Society, Esfahan University, Esfahan, September 1998, p. 11 (abstract).

Esmaeili Fereidouni, A., Fathi, N. and Kazem Khalesi, M. 2013. Enrichment of *Daphnia magna* with canola oil and its effects on the growth, survival and stress resistance of the Caspian Kutum (*Rutilus frisii kutum*) larvae. Turkish Journal of Fisheries and Aquatic Sciences, 13(1):119-126.

Esmaeili Rad, A., Alishahi, M., Ghorbanpour, M. and Zarei, M. 2014. The effects of oral administration of extracted chitosan from white leg shrimp (*Litopenaeus vannamei*) on hematological and growth indices in common carp (*Cyprinus carpio*). Journal of Veterinary Research, 69(4):385-393. In Farsi.

Esmaeilipoor Poode, S., Rahmani, H., Asadi Namavar, M. and Jouladeh, A. 2015. Comparison of morphometric and meristic characteristics of spirlin *Alburnoides eichwaldii* (De Filippi, 1863) in the rivers of Tajan, Aras and Babolrood. Journal of Experimental Animal Biology, 3(3):23-30. In Farsi.

Esmaeilipoor Poode, S., Rahmani, H. and Ghorbani, R. 2015. A survey on feeding habits of

spirlin (*Alburnoides eichwaldii*) in Tajan River, Mazandaran province. Journal of Animal Environment, 7(2):121-130. In Farsi.
Esmaeilzadegan, E. 2013. Comparison of morphological characteristics of the sang-lis (*Garra ruffa*) (*sic*) and Iranian cave fish (*Iranocypris typhlops*). M.Sc. Thesis, University of Tehran. 71 pp. In Farsi.
Esmaeilzadeh, K. R., Sahari, M. A. and Hamidi, E. Z. 2004. Comparative study on nutrient compositions of kutum (*Rutilus frisii kutum*) and grass carp (*Ctenopharyngodon idella*) and their marinade qualities. Iranian Scientific Fisheries Journal, 12(4):13-28. In Farsi.
Esmaeli, F. and Abbasi, S. 1996. The effect of *Bothriocephalus* invasion on blood parameters of grass carp. Iranian Scientific Fisheries Journal, 5(3):19-26, 2. In Farsi.
Esmaili, A., Ryahi, A. and Savari, A. 1999. Determination of heavy metals (Cd, Co, Pb, Ni, Zn and Cu) in water, sediments and fish from the Karun River. Iranian Journal of Natural Resources, 52(2):37-46. In Farsi.
Esmaili, F. and Peighan, R. 1997. Isolation of Aeromonas-like bacteria from the grass carp (*Ctenopharyngodon idella*). Iranian Scientific Fisheries Journal, 6(2):1-8, 1-2. In Farsi.
Esmaili Sari, A., Abtahi, B., Seifabadi J., Khodabandeh, S. and Ershad, H. 2001a. Occurrence of ctenophores in the Caspian Sea and its environmental consequences. In: The Fifth Iranian Symposium on Marine and Atmospheric Science and Technology, Bandar Abbas.
Esmaili Sari A., Abtahi, B., Seifabadi, J., Khodabandeh, S. and Ershad, H. 2001b. A study on the density and distribution of comb-jelly, *Mnemiopsis leidyi*, in the Caspian Sea. Daneshvar Medicine, 8(31):145-148. In Farsi.
Esmaili Sari A., Abtahi, B., Seyfabadi, J. and Khodabandeh, S. 2001. Invasive comb-jelly and future of the Caspian Sea. Naghshe Mehr Publication, Tehran, p. 144. In Farsi.
Esmaili Sari A., Abtahi, B., Talaei, R. and Sifabadi, J. 2002. Recherche sur la distribution et la densite du cnidaire *Mnemiopsis leidyi*, le longe de cote meridionale de la Mer Caspienne. 126eme Congres la Societe Zoologique de France du 16 au 18 septembre 2002, Plouzane-Brest, France (title).
Esmaili Sari, A., Imandel, K. A. and Georgez, Sh. 2001. The valuation of the damages resulting from oil material on Shadegan Wetland environment. Journal of Environmental Science and Technology, 2001(9):21-30. In Farsi.
Esmaili Sari, A., Khodabandeh, S., Abtahi, B., Seyfabadi, J. and Ershad, H. 1999. The first report on the occurrence of a comb jelly in the Caspian Sea. Journal of Environmental Science and Technology, 1999(3):63-68. In Farsi.
Esmaili Sari, A., Saifabadi, J., Khodabandeh, S., Abtahi, B. and Talayi, R. 2001. Feeding regime of comb-jelly (*Mnemiopsis leidyi*) from Caspian Sea. Daneshvar Medicine, 8(31):139-144. In Farsi.
Esmailzadeh, K. R., Sahari M. A. and Hamidi, E. Z. 2004. Comparative study on nutrient compositions of kutum (*Rutilus frisii kutum*) and grass carp (*Ctenopharyngodon idella*) and their marinade qualities. Iranian Scientific Fisheries Journal, 12(4):13-28, 2-3. In Farsi.
Esteky, A. A. 2001. Conditions of pH and ionic composition of water in a macrophyte dominated reservoir (Hanna Reservoir - Isfahan Province), Iran. Iranian Journal of Fisheries Sciences, 3(1):23-38, 90.
Esteky, A. A. 2006a. Determination of best condition for fermentation of organic manure for utilization in aquaculture. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Esfahan. http://en.ifro.ir

(abstract).
Esteky, A. A. 2006b. Hydrological and hydrobiological survey for determination of fish production potential in eastern area of Esfahan. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Esfahan. http://en.ifro.ir (abstract).

Estoky, A. 2000. Final report: assessment of fish production in Hanna River. Natural Resources Research Center and Livestock Affairs. Isfahan Publication, Isfahan.

Etessami, S. 1982. L'histologie des gonades chez deux cyprinides *Alburnoides bipunctatus eichwaldi* (Filipi, 1863) (*sic*) et *Barbus mursa miliaris* (Karaman, 1972) (*sic*) avec la description d'un cas d'hermaphrodisme chez ce dernier. Cybium, 6(2):5-13.

Ettefaghdoost, M. and Alaf Noveirian, H. 2020a. Assessment of heavy elements bioaccumulation in muscle tissue of the common bream (*Abramis brama orientalis* Berg, 1905) (Case study: Siah Darvishan River, Guilan province, Iran). Journal of Natural Environment (Iranian Journal of Natural Resources), 73(2):199-210. In Farsi.

Ettefaghdoost, M. and Alaf Noveirian, H. 2020b. Measurement of heavy metals concentration in the muscle tissue of Caspian roach (*Rutilus rutilus caspicus* Yakovlev, 1870) (Case study: Siah Darvishan River, Guilan province, Iran). Journal of Environmental Science and Technology, 22(8):223-236. In Farsi.

Ettefaghdoost, M. and Noveirian, H. A. 2019. The study of heavy metal accumulation in muscle tissue of vimba bream (*Vimba vimba*) in the Siah Darvishan River, Guilan province, Iran. Journal of Animal Environment, 11(1):203-210. In Farsi.

Everard, M. 2006. The Complete Book of the Roach. Medlar Press, Ellesmere. 436 pp.

Eydizadeh, A., Eskandary, G. R. and Hashemi, S. A. R. 2014. Some biological aspect of *Carasobarbus luteus* (Heckel, 1843) in Hoor al-Azim wetland. Scientific Journal of Biological Sciences, 3(3):29-6.

Eydizadeh, A., Eskandary, Gh., Mohammadi, Gh. And Hashemi, S. A. R. 2013. Population dynamics and assessment of *Carasobarbus luteus* (Heckel, 1843) in Hooral-Azim Wetland (Khuzestanprovinces (*sic*), Iran). World Journal of Fish and Marine Sciences, 5(4):430-436.

Ezatkhah, M., Alimolaei, M. and Sharifi, H. 2014. A survey of Monogenea and Digenea trematodes prevalence in warm water cultivated Cyprinidae in Kerman Province. Journal of Aquatic Animals and Fisheries, 5(18):41-49. In Farsi.

F

Faal, Z. 2009. Investigation of physicochemical factors of water in Bahmanshir River, Khouzestan Province, Iran. Iranian Scientific Fisheries Journal, 18(1):167-172. In Farsi.

Fadaei, A., Dehghani, M. H., Nasseri, S., Mahvi, A. H., Rastkari, N. and Shayeghi, M. 2012. Organophosphorous pesticides in surface water of Iran. Bulletin of Environmental Contamination and Toxicology, 88(6):867-869.

Fadaei Fard, F., Mokhayer, B. and Ghorbani, H. 2001. Study of fish parasites in the lagoon of Choghakhor, Chaharmahal-va-Bakhtiari, Iran. Journal of the Faculty of Veterinary Medicine, University of Tehran, 56(3):109-114. In Farsi.

Fadaei Rayeni, R., Bidmal, H. R., Eiri, B. and Ghani, S. 2021. Effect of adding *Camellia sinensis* extract on blood biochemical parameters and liver enzymes in *Carassius auratus* in

exposure to heavy metal cadmium and mercury. Journal of Experimental Animal Biology, 9(3):29-41. In Farsi.

Fadaeifard, F., Raisi, M., Hosseini, S. R. and Javdanenia, M. 2010. An investigation of ectoparasites of goldfish (*Carassius carassius* L., 1758). Journal of Veterinary Pathobiology (Journal of Veterinary Modern Research), 1(4):17-24, 3. In Farsi.

Fadaeifard, F., Raissy, M., Faghani, M., Majlesi, A. and Nodeh Farahani, G. 2012. Evaluation of physicochemical parameters of waste water from rainbow trout fish farms and their impacts on water quality of Koohrang stream - Iran. International Journal of Fisheries and Aquaculture, 4(8):170-177.

Fadakar Masouleh, F. 2014. In vitro effects of kraft liquor on testicular cells and sperm motility of Caspian kutum (*Rutilus frisii kutum*). Iranian Journal of Fisheries Sciences, 13(4):918-930.

Fadakar Masouleh, F., Mojazi Amiri, B., Mirvaghefi, A. and Nematollahi, M. A. 2011a. A study on effects of copper and cadmium on sperm motility of Caspian kutum: *Rutilus frisii kutum*. Journal of Fisheries (Iranian Journal of Natural Resources), 64(1):65-73. In Farsi.

Fadakar Masouleh, F., Mojazi Amiri, B., Mirvaghefi, A. and Nematollahi, M. A. 2011b. A study on toxic effects of diazinon on the Caspian kutum (*Rutilus frisii kutum*) testis using in vitro tissue culture. Journal of Fisheries (Iranian Journal of Natural Resources), 64(2):121-128. In Farsi.

Fadakar Masouleh, F., Mojazi Amiri, B., Mirvaghefi, A. R. and Ghafoori, H. 2018. Effects of osmotic shock on some physiological parameters in Caspian kutum juveniles (*Rutilus kutum*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(4):363-375. In Farsi.

Fadakar Masouleh, F., Mojazi Amiri, B., Mirvaghefi, A. R. and Nematollahi, M. A. 2012. Effects of mercury on sperm motility and testis structure of Caspian kutum (*Rutilus frisii kutum*) by using in vitro experiments. Journal of Fisheries, 5(4):9-18. In Farsi.

Fadavei Hosseini, H., Ghomi, M. R., Jamalzadeh, H. R., Faghani, H., Jadid Dokhani, D. and Hasandoust, M. 2010. Comparison of physiochemical factors for inlet and outlet of trout farms in Tonekabon's Dohezar River. New Technologies in Aquaculture Development (Journal of Fisheries), 4(2):77-82. In Farsi.

Faddagh, M. S., Hussain, N. A. and Al-Badran, A. I. 2012. DNA fingnerprinting (*sic*) of eight cyprinid fish species of Iraqi inland waters using RAPD-PCVR technique. Advances in Life Sciences, 2(2):9-16.

Fadei, A. and Gafari, M. 2014. Physico-chemical assessment of the Zayandeh Rud River, Iran, using water quality index. Journal of Applied Sciences in Environmental Sanitation, 9(3):199-204.

Faeed, M., Omidvar, S., Ghasemi, M., Mehrabi, M., Hasheminasab, F. and Daghigh Rohi, J. 2018. The study of zoonotic bacteria in gold fish (*Carassius auratus auratus*) of Guilan province farms. Iranian Scientific Fisheries Journal, 27(4):87-96. In Farsi.

Faghani Langroudi, H. 2010. The comparison between the effect of two dietary prebiotics (Primalc® and Protexin®) on the growth and the survival rate of Caspian Sea common carp (*Cyprinus carpio*). Journal of Marine Biology, 2(2):65-74. In Farsi.

Faghani Langroudi, H. 2011. Application of combined effect of sodium acetate and nisin on reduction of contamination by *Listeria monocytogenes* in vacuum packaged grass carp (*Ctenopharyngodon idella*) fillets kept at 4°C. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 82 pp. In Farsi.

Faghani-Langroudi, H., Esmailpour-Chokami, H., Eslamkhah-Taghizad, M-M., Rohani-Rad, M. and Mousavi-Sabet, H. 2014. Length-weight and length-length relationships of *Cyprinion macrostomum* from the Tigris River drainage. AACL Bioflux, 7(4):235-240.

Faghani Langroudi, H. and Mousavi Sabet, H. 2018. Reproductive biology of lotak, *Cyprinion macrostomum* Heckel, 1843 (Pisces: Cyprinidae), from the Tigris River drainage. Iranian Journal of Fisheries Sciences, 17(2):288-299.

Faghani Langroudi, H., Nikoo, M. and Alekhorshid, M. 2015. Effect of extraction time on properties of gelatin from the skin of crucian carp (*Carassius carassius*). New Technologies in Aquaculture Development (Journal of Fisheries), 9(3):105-112. In Farsi (also listed as 2016, 9(4):51-58).

Fahim, A., Khanipour, A. A., Zare Gushte, G. and Amiri Sandisi, S. A. 2017. Improved sensory properties and shelf life of burger made from silver carp (*Hypophthalmichthys molitrix*) using pectin. Journal of Fisheries Science and Technology, 6(3):123-131. In Farsi.

Fahim Dezhban, Y. 2013. The effect of *Rosmarinus officinalis* and *Zataria multiflora* extracts on the stability of poly unsaturated fatty acids in frozen silver carp minced. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 214 pp. In Farsi.

Fahimdezhban, Y. 2008. Processing of Fishery Products. Mehr Alnabi Publications, Tehran. 291 pp.

Fahimdezhban, Y., Motallebi, A. A., Hosseini, E., Khanipour, A. A. and Soltani, M. 2014. Comparison of effect of *Zataria multiflora* and *Rosemarinus officinalis* extracts on quality of minced frozen silver carp. Iranian Journal of Fisheries Sciences, 13(1):20-29.

Fahimdezhban, Y., Motallebi, A. A., Hosseini, E., Khanipour, A. A., Soltani, M., Zare Gashti, Gh. and Khodabandeh, F. 2013. Study on effect of *Rosemarinus officinalis* and *Zataria multiflora* extracts on the stability of fatty acids in frozen silver carp minced. Iranian Scientific Fisheries Journal, 22(2):87-98. In Farsi.

Faizbakhsh, R. and Gheshlaghi, P. 2012. Measurements of multi factors effects gold fish larvae growth and quality with feeding treatments by mathematics matrix. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 158-165.

Fakhri, Y., Djahed, B., Toolabi, A., Raoofi, A., Gholizadeh, A., Eslami, H., Taghavi, M., Alipour, M. R. and Mousavi Khaneghah, A. 2020. Potentially toxic elements (PTEs) in fillet tissue of common carp (*Cyprinus carpio)*: a systematic review, meta-analysis and risk assessment study. Toxin Reviews, doi:10.1080/15569543.2020.1737826.

Fakouri, B., Mazaheri, M. and Mohammadvali Samani, J. 2019. Management scenarios methodology for salinity control in rivers (case study: Karoon River, Iran). Journal of Water Supply: Research and Technology-Aqua, 68(1):74–86.

Falahatkar, B. 1999. Determination of palatable aquatic plants in nutrition of grass carp, *Ctenopharyngodon idella*. Agriculture and Industry, 5:28-29. In Farsi.

Falahatkar, B. 2015. Status of fishing in southern part of the Caspian Sea. Global Conference on Inland Fisheries, Rome, 26-28 January 2015. 23 pp.

Falahatkar, B., Abdi, H. and Mahmoudi, N. 2011. Physiology and growth may be affected by supplementary nucleotide in common carp. Asian-Pacific Aquaculture, 17-20 January 2011, Kochi, India (title).

Falahatkar, B., Abdi, H. and Mahmoudi, N. 2012. The role of dietary nucleotide on energy sources and growth function of common carp (*Cyprinus carpio*). Iranian Scientific

Fisheries Journal, 21(1):133-146. In Farsi
Falahatkar, B., Bagheri, M. and Efatpanah, I. 2019. The effect of stocking densities on growth performance and biochemical indices in new hybrid of *Leuciscus aspius* ♀ x *Rutilus frisii* ♂. Aquaculture Reports, 15:100207.
Falahatkar, B., Efatpanah, I., Meknatkhah, B. and Rahmati, M. 2015. Potential of aspikutum (a hybrid of *Leuciscus aspius* ♀ x *Rutilus frisii* ♂) for aquaculture: comparison of growth performance in earthen ponds and tanks. Iranian Journal of Ichthyology, 2(3):224-226.
Falahatkar, B., Efatpanah, I., Meknatkhah, B., Tolouei, M. H. and Kucharczyk, D. 2010. Induced spawning of asp (*Aspius aspius taeniatus*) using ovaprim and carp pituitary extract. 10th University of Guilan Scientific Research Conference, 8-10 May 2010, Guilan (title).
Falahatkar, B., Kamalikia, M. R. and Efatpanah, I. 2019. Fat requirement of hybrid asp (*Leuciscus aspius* ♀) x Caspian kutum (*Rutilus frisii* ♂): effect on growth and biochemical indices. Journal of Applied Ichthyological Research, 7(3):125-142. In Farsi.
Falahatkar, B., Meknatkhah, B. and Efatpanah, I. 2013. Hybrid production of asp (*Aspius aspius*) × Caspian Kutum (*Rutilus frisii kutum*): A preliminary results of fertilization. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Falahatkar, B., Mohammadi, H. and Noveirian, H. 2012. Effects of different starter diets on growth indices of Caspian kutum, *Rutilus frisii kutum* larvae. Iranian Journal of Fisheries Sciences, 11(1):28-36, III.
Falahatkar, B., Poursaeid, S., Efatpanah, I., Ershad Langroudi, H. and Meknatkhah, B. 2011. Spawning induction in kutum *Rutilus kutum* using different hormonal administrations: analysis of hormone profile and success of induction. Diversification in Inland Finfish Aquaculture, 16-18 May 2011, Pisek, Czech Republic (title).
Falahatkar, B., Poursaeid, S., Efatpanah, I., Ershad Langroudi, H., Tolouei, M., Meknatkhah, B., Akhavan, S. R. and Eslamloo, K. 2010. Ovulation induction in kutum *Rutilus frisii kutum* using different hormonal administrations. Aquaculture Europe 2010, 5-8 October 2010, Porto, Portugal (title).
Falahatkar, B., Safarpour-Amlashi, A., Eagderi, S. and Mousavi-Sabet, H. 2015. Review on the Caspian shemaya, *Alburnus chalcoides* (Güldenstädt, 1772). International Journal of Aquatic Biology, 3(5):323-330.
Falahatkar, B., Sajjadi, M., Kolangi Miandare, H., Kestemont, P. and Roosta, Z. 2019. A comparative study on some biochemical and enzymatic parameters of plasma and mucus during reproductive stages in goldfish (*Carassius auratus*). Journal of Animal Researches (Iranian Journal of Biology), 33(2):160-171. In Farsi.
Falahatkar, B. and Tolouei Gilani, M. H. 2009. Sex identification of asp (*Aspius aspius taeniatus*) using laparoscopic method. Aquaculture America 15-18 February 2009, Seattle (title).
Falahatkar, B. and Tolouei Gilani, M. H. 2013. Use of laparoscopy for sex identification of asp *Aspius aspius*. North American Journal of Fisheries Management, 33(5):894-899.
Falahatkar, B. and Yasemi, M. 2001a. Stocks condition *Aspius aspius taeniatus* in the south coastline of the Caspian Sea. Veterinarian, 2(14):44-47.
Falahatkar, B. and Yasemi, M. 2001b. Stocks condition *Aspius aspius taeniatus* in the south coastline of the Caspian Sea. First National Conference of Bony Fishes and Fishery in Caspian Sea, 29-30 December 2001, Bandar Anzali (title).
Falamarzi, Z., Mousavi, S. M., Zakeri, M. and Zanguee, N. 2016. Effects of different levels of

meal and alcoholic extract of alfalfa (*Medicago sativa*) on growth performance, nutrition, carcass biochemical and some serum biochemical parameters in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(2):235-251. In Farsi.

Falcon, N. L. 1974. Southern Iran: Zagros Mountains, pp. 199-211. In: Spencer, A. M. (Ed.). Mesozoic-Cenozoic Orogenic Belts. Data for Orogenic Studies. Special Publication, Geological Society, London, 4:xvi + 809 pp.

Fallah, M. and Isfahani, S. F. 2016. Impacts of land use changes on water quality of Anzali International Wetland. Journal of Oceanography, 6(24):53-59. In Farsi.

Fallah, M., Pirali Zefrehei, A. R., Hedayati, S. A. and Bagheri, T. 2021. Comparison of temporal and spatial patterns of water quality parameters in Anzali Wetland (southwest of the Caspian Sea) using support vector machine model. Caspian Journal of Environmental Sciences, 19(1):95-104.

Fallah, M. and Zamani-Ahmadmahmoodi, R. 2017. Assessment of water quality in Iran's Anzali Wetland, using qualitative indices from 1985, 2007, and 2014. Wetlands Ecology and Management, 25(5):597-605.

Fallah Daryasari, H. and Mohammadi Galangash, M. 2021. Transmission of invasive species in the Caspian Sea and environmental crises. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Fallah Shamsi, S. Z. and Khara, H. 2015a. Study on spermatological characteristics and its affection artificial propagation efficiency of immigrant kutum (*Rutilus frisii kutum*, Kamenskii 1901) to Sefidroud River. Journal of Experimental Animal Biology, 4(1):19-26. In Farsi.

Fallah Shamsi, S. Z. and Khara, H. 2015b. Influence of broodstock age on sperm quality traits in *Rutilus frisii* and its effects on fertilization success. Iranian Journal of Fisheries Sciences, 14(4):985-996.

Fallah Shamsi, S. Z., Khara, H. and Baradaran Noveiri, Sh. 2015. Spermatological characteristics and its effection on artificial propagation efficiency of immigrant kutum (*Rutilus frisii kutum*, Kameneskii (*sic*) 1901) to Sefidroud River. New Technologies in Aquaculture Development (Journal of Fisheries), 9(3):1-8. In Farsi.

Fallah Shamsi, S. Z., Nezami, S. A., Khara, H., Baradaran Noveiri, S., Alipour, A. R., Alijanpour, N. and Amiri, K. 2011. Study on effect of ionic compounds of sperm on efficiency of artificial reproduction in kutum fish (*Rutilus frisii kutum* Kamenskii, 1901) immigrant to the Sefid-River. Journal of Aquatic Animals and Fisheries, 2(5):31-35. In Farsi

Fallah Shamsi S. Z., Nezami Shaban, A., Khara, H., Baradaran Noveiri, S., Baghizadeh, E. and Ali Nia, M. 2011. The effect of biochemical composition of sperm on artificial reproduction efficiency in kutum (*Rutilus frisii kutum*) immigrant to the Sefid-Roud. Journal of Marine Biology, 3(3):59-64. In Farsi.

Fallahbagheri, F. 2010. Comparison of genetic variation of wild common carp *Cyprinus carpio* in the Anzali wetland using PCR-RLFP. M.Sc. Thesis, Isfahan University of Technology. In Farsi.

Fallahbagheri, F., Dorafshan, S., Pourkazemi, M., Keivany, Y. and Chakmedouz Qasemi, F. 2013a. Genetic analysis of wild common carp, *Cyprinus carpio* L. in the Anzali wetland, the Caspian Sea. Iranian Journal of Fisheries Sciences, 12(1):1-11.

Fallahbagheri, F., Dorafshan, S., Pourkazemi, M., Keivany, Y. and Chakmedouz Qasemi, F. 2013b. An investigation of the PCR-RFLP variation of the mtDNA control region (D-loop) in estuarine and wetland types of wild common carp, *Cyprinus carpio*, in the south-west Caspian Sea. Modern Genetics Journal, 8(2)(33):213-220. In Farsi.
Fallahi, M. 2010. The effects of slurry on larviculture of *Rutilus frisii kutum* and Chinese carp yield and determination of efficient concentration for increasing of production. Iranian Fisheries Science Research Institute, Tehran. 158 pp. In Farsi.
Fallahi, M. 2012. Analyzing the effects of aquaculture and rebuild aquatics stocks on fisheries development in the Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 504 pp. In Farsi.
Fallahi, M., Amiri, A., Arshad, N., Moradi, M. and Daghigh Roohi, J. 2013. Culture of Chinese carps using anaerobic fermented cow manure (slurry) and comparison of survival and growth factors versus traditional culture. Iranian Journal of Fisheries Sciences, 12(1):56-75.
Fallahi, M., Daghigh Roohi, J., Nahrevar, M. R., Moradi Chafi, M. and Sarpanah, A. 2004. The role of rotifer (*Brachionus plicatilis*) in increasing survival of *Rutilus frisii kutum* larvae and its comparison by concentrated food. Pajouhesh va Sazandegi, 17(2)(63):66-71. In Farsi.
Fallahi Kapourchali, M. 2018. The trend of aquatic communities changes in Anzali wetland. Inland Waters Aquaculture Research Center, Iranian Fisheries Science Research Institute, Agricultural Research, Education and Extension Organization, Ministry of Jihad-e Agriculture. 145 pp. In Farsi.
Fallahi Kapourchali, M., Hogat Khodaparast, S., Makaremi, M., Khatib, S. and Valipour, A. 2019. Study on phytoplankton situation in Neor Lake after the arrival of the *Carassius gibelio*. Journal of Aquaculture Development, 13(3):77-90. In Farsi.
Fallahpour, F., Banaee, M. and Javadzade, N. 2017. Effects of administration of marshmallow extract (*Althaea officinalis* L.) on blood cells and some liver enzyme activities in common carp (*Cyprinus carpio* L.). Journal of Aquaculture Development, 11(1):105-117. In Farsi.
Fang, P.-W. 1942. Sur certains types peu connus de Cyprinidés des collections du Muséum de Paris. Bulletin du Muséum national d'Histoire naturelle, Paris, (2)14:169-172.
Farabi, S. M. V. 2017. Survey and feasibility study for the introduction of native fish and non-native fish for cage culture in the southern part of Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 90 pp. In Farsi.
Farabi, S. M. V., Hedayatifard, M., Behrouzi, Sh. and Sharifian, M. 2013. The determination of *Rutilus frisii kutum* (< 1000 mg) resistance to salinity and turbidity. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Farabi, S. M. V., Khoshbavar Rostami, H., Ghaneei Tehrani, M., Ghiasi, M., Azari, A., Behrouzi, S., Mosavi, H., Firozkandian, S. and Habibi, F. 2007. The investigation of status brood stocks and releasing fingerlings of *Rutilus frisii kutum* (Kaminski, 1901) in the south of Caspian Sea (Mazandaran province, 2004). Pajouhesh va Sazandegi, 19(1)(74):156-166. In Farsi.
Farabi, S. M. V., Matinfar, A., Behrouzi, S., Sharifian, M. and Ghaneei Tehrani, M. 2020. Investigation effect of salt supplementation on change of gill and kidney tissues of *Rutilus kutum*. Journal of Aquaculture Development, 14(1):63-78. In Farsi.

Farabi, S. M. V., Pourgholam, R. and Azari, A. H. 2020. Investigate the possibility of rearing fish in cages in the southern coast of Caspian Sea with emphasis on the parameters of temperature, salinity and dissolved oxygen water. New Technologies in Aquaculture Development (Journal of Fisheries), 14(1):10-20. In Farsi.

Farahbakhsh, Z., Akbarzadeh, A. and Naji, A. 2019. Health risk assessment of trace metals Cu, Zn, Ni via the consumption of the prevailing bony fish *Rutilus frisii kutum* (Kamensky, 1901), and *Vimba vimba persa* (Linnaeus, 1754) (*sic*) in Caspian Sea. Iranian Scientific Fisheries Journal, 28(3):77-88. In Farsi.

Farahbod Roudbaraki, A., Moradinasab, A., Jourdehi, A. Y., Bahmani, M., Akbarzadeh, A. and Hallajian, A. 2017. Study on some biological characteristic of sharpbelly (*Hemiculter leucisculus*, Basilewsky, 1855) from Anzali Wetland. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Farahi, A., Sudagar, M., Yousefi Siahkalroodi, S., Mazandarani, M., Dadgar, S. and Ojagh, S. M. 2018. Comparison of growth performance, fillet efficiency and amino acid profile of common carp (*Cyprinus carpio*) and giant gourami (*Osphronemus goramy*) reared in concrete pools. Journal of Aquaculture Sciences, 6(1):32-41. In Farsi

Farahi, A., Sudagar, M., Yousefi Siahkalroodi, S., Mazandarani, M., Dadgar, S. and Ojagh, S. M. 2019. Comparison of fillet quality and fatty acids profile of giant gourami (*Osphronemus goramy*) and common carp (*Cyprinus carpio*) reared in concrete ponds. Journal of Animal Environment, 11(3):205-212. In Farsi.

Farahmand, F. 2015. Survey of environmental effects of Fe, As and Cd on the underground water sources of Tehran suburb villages for the use of artificial lakes of fish farming. Journal of Animal Environment, 7(1):229-238. In Farsi.

Farahmandfar, R., Safari, R., Ahmadi Vavsari, F. and Bakhshandeh, T. 2015. The effect of ajwain (*Trachyspermum ammi*) extracted by ultrasound-assisted solvent on quality properties of silver carp (*Hypophthalmichthys molitrix*) surimi stored at 4ºC. Journal of Food Processing and Preservation, 40(2):291-297.

Farahnak, A. 2000a. Fish Anisakidae in Khuzestan province of South West Iran. In: Ecological Parasitology on the Turn of the Millennium, St. Petersburg, Russia, 1-7 July 2000 (abstract).

Farahnak, A. 2000b. Fish Anisakidae in Khuzestan province of South West Iran. Bulletin of the Scandinavian Society for Parasitology, 10(2):71.

Farahnak, A., Mobedi, I. and Tabibi, R. 2002. Fish Anisakidae helminthes in Khuzestan Province, south west of Iran. Iranian Journal of Public Health, 31(3-4):129-132.

Farajifard, M., Nasirian, N. and Ghasemnejad, H. M. 2015. The economic and energy indicators of once and twice-harvest systems of hydrothermal fish in climatic conditions of Khuzestan province. Research Journal of Fisheries and Hydrobiology, 10(10):250-256.

Farakhroz, M., Zamini, A. and Mozafari, E. 2013. Effects of formalin and copper sulfate on gill tissues of Khaza white fish (*Rutilus kutum*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 6(4):27-35. In Farsi.

Farakhroz, M., Zamini, A. and Mozafari, E. 2014. Effects of formalin and copper sulfate on skin tissues of Khazar white fish (*Rutilus kutum*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 7(1):49-58. In Farsi.

Faramarzi, M. 2012. Assessment of reproductive parameters in silver carp (*Hypophthalmichthys molitrix*). World Journal of Fish and Marine Sciences, 4(3):244-248.

Faramarzi, M., Lashkarboloki, M., Kiaalvandi, S., Jalaee, M. H. and Iranshahi, F. 2011.

Influences of using different levels of sweet potato peels on growth and feeding parameters and biochemical responses of *Cyprinus carpio* fish. World Journal of Fish and Marine Sciences, 3(3):232-238.

Faramarzi, N. 2012. Agricultural Water Use in Lake Urmia Basin, Iran: An Approach to Adaptive Policies and Transition to Sustainable Irrigation Water Use. M.Sc. Thesis, Department of Earth Sciences, Uppsala University, vii + 44 pp. + 11 pp.

Faramazpour Darzini, S., Alizadeh Doughikollaee, E., Shahriari Moghadam, M. and Elahi, M. Y. 2018. Effect of *Carum copticum* seed essential oil on the *Escherichia coli* inoculated in minced *Cyprinus carpio*. Journal of Aquaculture Sciences, 6(1):92-104. In Farsi.

Farashi, A., Kaboli, M. and Rahimian, H. 2013. Habitat management of the Iranian cave barb (*Iranocypris typhlops*) using AHP-SWOT method. Journal of Animal Environment, 5(3):41-51. In Farsi.

Farashi, A., Kaboli, M., Rahimian, H., Rezaei, H. R. and Naghavi, M. R. 2015. Selecting suitable habitat for translocation of Iranian blind cave fish (*Iranocypris typhlops*). Journal of Natural Environment, 68(3):443-459. In Farsi.

Farashi, A., Kaboli, M., Reza Rezaei, H., Reza Naghavi, M. and Rahimian, H. 2014. Plankton composition and environmental parameters in the habitat of the Iranian cave barb (*Iranocypris typhlops*) in Iran. Animal Biodiversity and Conservation, 37(1):13-21.

Farashi, A., Kaboli, M., Reza Rezaei, H., Reza Naghavi, M., Rahimian, H. and Coad, B. W. 2014. Reassessment of the taxonomic position of *Iranocypris typhlops* Bruun & Kaiser 1944 (Actinopterygii: Cyprinidae). ZooKeys, 374:69-77.

Farazmandi, M., Mojazi Amiri, B. and Ahmadi, M. 2010. Proper broodstock selection based on oocyte polarization index in *Rutilus frisii kutum* Kamensky, 1901. Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):11-18. In Farsi.

Fardanian, S. M., Yazdani Moghadam, F., Darvish, J., Ghassemzadeh, F. and Seifali, M. 2016. Morphology characteristics of the Iranian spirlin (Cyprinidae: *Alburnoides* Jeitteles, 1861) in the Tabarakabad River of Khorasan Razavi Province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Fardanian, S. M., Yazdani Moghadam, F., Ghassemzadeh, F. and Darvish, J. M. 2016. Phylogeny of *Alburnoides* Jeitteles, 1861 (Actinopterygii: Cyprinidae) from Khorasan Razavi province using cytochrome oxidase subunit 1. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Farhadian, O., Kolivand, S., Ebrahimi Dorche, E. and Mahboobi Soofiani, N. 2014. Distribution and community structure of crustacean mesozooplankton of Hanna Wetland, Isfahan Province. Journal of Animal Research (Iranian Journal of Biology), 26(4):443-459. In Farsi.

Farhang, P. and Eagderi, S. 2019. Skeletal ontogeny of the caudal complex in Caspian kutum, *Rutilus kutum* (Kamensky, 1901) (Teleostei: Cyprinidae) during early development. Caspian Journal of Environmental Sciences, 17(2):113-119.

Farhangi, M. 2010. In vitro determination of LC_{50}96h of zinc on common carp (*Cyprinus carpio*). 2nd International Congress on Aquatic Animal Health Management and Disease, Tehran, 26-27 October 2010.

Farhangi, M. 2018. The study of acute toxicity of nickel ($NiSO_4$) and iron ($FeSO_4$) to *Rutilus frisii kutum* by water static method. Journal of Applied Ichthyological Research, 6(4):97-108. In Farsi.

Farhangi, M., Gholipour Kanani, H., Aliakbariyan, A. and Kashani, M. 2014. Effect of copper sulphate on behavioural and histopathological changes in roach, *Rutilus rutilus caspicus*. Caspian Journal of Environmental Sciences, 12(1):73-79.

Farhangi, M., Hajimoradloo, A. M. and Rostami Charati, F. 2014. Determination of lethal concentration of 50, 96h of zinc (LC_{50}96h, $ZnSO_4$) on common carp (*Cyprinus carpio*) under experimental condition. Journal of Animal Researches (Iranian Journal of Biology), 27(1):119-125. In Farsi.

Farhangi, M., Hoseini, S. A., Jafaryan, H., Ghorbani, R., Harsij, M. and Sudagar, M. 2018. Impact of sturgeon pen culture on the water quality in Gorgan Gulf. Journal of Animal Environment, 10(2):217-230. In Farsi.

Farhoudi, A., Abedian Kenari, A., Nazari, R. M. and Makhdomi, C. 2011. Changes in fatty acid profile of common carp (*Cyprinus carpio*) during larval development. Journal of Fisheries (Iranian Journal of Natural Resources), 64(2):129-143. In Farsi.

Farhoudi, A., Abedian Kenari, A. M., Nazari, R. and Makhdoomi, C. 2013. Amino acid profile of Caspian carp (*Cyprinus carpio*) during ontogenetic development: applications to feed formulations. Ecopersia, 1(3):261-271.

Farhoudi, A., Abedian Kenari, A. M., Nazari, R. and Makhdoomi, Ch. 2013. Changes of digestive enzymes activity in common carp (*Cyprinus carpio*) during larval ontogeny. Iranian Journal of Fisheries Sciences, 12(2):320-334.

Farhoudi, A., Abedian Kenari, A. M., Nazari, R. M. and Makhdoomi, C. 2011. Study of body composition, lipid and fatty acid profile during larval development in Caspian Sea carp (*Cyprinus carpio*). Journal of Fisheries and Aquatic Sciences, 6(4):417-428.

Farhoudi, A., Abedian Kenari, A.M., Nazari, R. M. and Makhdoomi, C. H. 2011. Study of body composition, lipid and fatty acid profile during larval development in Caspian Sea carp (*Cyprinus carpio*). Journal of Fisheries and Aquatic Sciences, 6(4):417-428.

Farid-Pak, F. 1957. Fishes of the Caspian Sea on the north borders of Iran. Journal of Veterinary Medicine, Tehran, 4:12-24. In Farsi.

Farid-Pak, F. 1963. Société Anonyme des Pêcheries Iraniens. Keyhan Press, Tehran.

Farid-Pak, F. 1965. Caspian Sea fishes. Fisheries Research Institute, Bandar Pahlavi, Iran. In Farsi.

Farid-Pak, F. 1966. Fishes of the Caspian Sea area and the northern shores of Iran. Leaflet No. 6, Shilot Industrial Fish Study Institute of Iran, Bandar Pahlavi. In Farsi.

Ferid-Pak (Farid-Pak), F. 1968. Fertility of the kutum Rutilus frisii kutum (Kamensky). Voprosy ikhtiologii, 8(1):61-68.

Farid-Pak, F. No date. Société anonyme des Pècheries (*sic*) iraniennes. Bank Melli Iran Press, Tehran. 10 pp.

Farjami, B. and Hosseinie, S. 2014. The effect of thyme extract (*Zataria multiflora*) on the microbial and chemical quality of surimi common carp (*Cyprinus carpio*) during refrigerator storage (1 ± 4ºC). Journal of Utilization and Cultivation of Aquatics, 3(1):55-66. In Farsi.

Farjami, B. and Vali Hosseini, S. 2015a. A study on the effect of rosemary extract (*Rosmarinus officinalis*) on the quality of fish fingers produced from silver carp (*Hypophthalmichthys molitrix*). Journal of Fisheries, 67(4):599-610, 10. In Farsi.

Farjami, B. and Vali Hosseini, S. 2015b. Effect of thyme extract on the chemical quality of raw surimi produced from common carp (*Cyprinus carpio*) during refrigerator storage. Journal of Fisheries (Iranian Journal of Natural Resources), 68(3):447-456. In Farsi.

Farmitani, Z. 2021. Investigating the importance of protecting rivers in the Caspian Sea basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.

Farokhi, F. 2014. The survey on determination of malathion biomarker with genotoxicity and ecophysiological reactions in the Caspian roach (*Rutilus rutilus caspicus*). Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 129 pp. In Farsi.

Farokhi, F., Jamili, Sh., Shahidi, M., Mashinchian, A. and Vosoughi, Gh. 2016. Effect of malathion insecticide on liver tissue and enzymes of *Rutilus rutilus caspicus* of the Caspian Sea. Iranian Scientific Fisheries Journal, 24(4):117-126. In Farsi.

Farokhi, F., Jamili, Sh., Shahidi, M., Mashinchian, A. and Vosoughi, Gh. H. 2014. The effect of malathion on the hematological parameters of *Rutilus rutilus caspicus*. Nautilus, 128(3)(1):106-114.

Farokhi, F., Jamili, Sh., Shahidi, M., Mashinchian, A. and Vosoughi, Gh. H. 2016. Histopathological survey of malathion on liver and gill tissues in Caspian roach (*Rutilus rutilus caspicus*). Journal of Animal Environment, 8(3):259-264. In Farsi.

Farokhrous Lashydany, M. 2007. Effect of butachlor on spermatogenesis, testosterone amount and testes tissue *Rutilus frisii kutum* Kamenskii 1901. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 155 pp. In Farsi.

Farokhroz, M., Zamini, A. and Mozafari, E. 2013. Effects of formalin and copper sulfate on gill tissues of khaza white fish (*Rutilus kutum*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 6(4):27-35. In Farsi.

Farokhroz, M., Zamini, A. and Mozafari, E. 2014. Effects of formalin and copper sulfate on skin tissues of khazar white fish (*Rutilus* kutum). Journal of Animal Physiology and Development (Journal of Biological Sciences), 7(1):49-58. In Farsi.

Farokhruz Lasheydani, M., Ghaseminejad, A., Falakro, K., Fahim, M. and Rahimibashar, M. R. 2010. The effect of butachlor on some hematological factors in Caspian roach (*Rutilus frisii kutum* Kamenskii1901). Journal of Biology Science, 4(1)(series no. 12):57-65. In Farsi.

Farooq, G., Mirza, M. R. and Masud-ul-Hasan. 1996. A contribution to the gut contents of *Cyprinion watsoni* (Day) (Pisces: Cyprinidae) from Pakistan. Second Symposium on Fish and Fisheries of Pakistan, November, 25, 26, 1996, Department of Zoology, Government College, Lahore, pp. 1-2 (abstract).

Farquharson, F. A. K., Meigh, J. R. and Sutcliffe, J. V. 1992. Regional flood frequency analysis in arid and semi-arid areas. Journal of Hydrology, 138(3-4):487-501.

Farr, M. J. 1977. Karue ru insurgence, Zagros Mts., Iran. Cave Diving Group Newsletter, U.K., 44:18-19.

Farr, M. J. 1984. The great caving adventure. Oxford Illustrated Press, Yeovil. 229 pp.

Farrand, W. R. 1979. Blank on the Pleistocene map. Geographical Magazine, 51(8):548-554.

Farshad, A. and Zinck, J. A. 1998. Traditional irrigation water harvesting and management in semiarid western Iran: A case study of the Hamadan region. Water International, 23(3):146-154.

Farvardin, Sh., Kolangi Miandareh, H., Shabani, A., Hoseinifar, S. H. and Ramezanpour, S. S. 2017. The effects of dietary administration of galactooligosaccharide on appetite-related (ghrelin) gene expression and some serum immune parameters and growth factor in gold

fish (*Carassius auratus gibelio*). New Technologies in Aquaculture Development (Journal of Fisheries), 11(2):13-28. In Farsi.

Farzadfar, F., Heidari, B. and Ghafoori Rahimabadi, Z. 2014. Morphohistology of male gonad in the Caspian Sea kutum (*Rutilus frisii kutum*). Journal of Oceanography, 4(16):15-22. In Farsi.

Farzi, R. and Fallahkar, B. 2018. The relationship between the length and weight of fish (*Blicca bjoerkna*) in Anzali wetland. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Farzi, R., Sajadi, M. M. and Falahatkar, B. 2019. The effects of dietary XTRACT on growth, survival, body composition *Carassius gibelio*. Journal of Aquaculture Sciences, 7(1):45-58. In Farsi.

Fataei, E., Mosavi, S. and Imani, A. A. 2012. Identification of anthropogenic influences on water quality of Aras River by multivariate statistical techniques. 2012 2nd International Conference on Biotechnology and Environment Management, IPCBEE, 42:3539.

Fatahi, S. 2013. Histopathological changes caused by diazinon on gonadal tissues, liver, kidney, intestine and gills of male goldfish. Journal of Utilization and Cultivation of Aquatics, 2(3):137-144. In Farsi.

Fatahi, S. 2015. Growth, feeding factors and the effect of salinity stress on the survival rate on roach (*Rutilus rutilus caspicus*) juveniles fed with different levels of betaine and tryptophan. Journal of Fisheries Science and Technology, 4(2):65-77. In Farsi.

Fatahi, S. and Hoseini, S. M. 2013. Effect of dietary tryptophan and betaine on tolerance of Caspian roach (*Rutilus rutilus caspicus*) to copper toxicity. International Journal of Aquatic Biology, 1(2):76-81.

Fatallohi, B. 1998. Study on lateral effects and wastage of Undosefalon in common carps. M.Sc. Thesis, Tarbiat Modarres University, Iran.

Fatemi, S. M., Kaymaram, F., Jamili, S., Taghavi Motlagh, S. A. and Ghasemi, S. 2009. Estimation of growth parameters and mortality rate of common carp (*Cyprinus carpio*, Linnaeus 1758) population in the southern Caspian Sea. Iranian Journal of Fisheries Sciences, 8(2):127-140.

Fatemi, S. M. R. and Hamidi, Z. 2010. Determination of cadmium and lead levels in muscle tissue of some edible fishes in Hour-al-Azim Wetland. New Technologies in Aquaculture Development (Journal of Fisheries), 4(1):95-100. In Farsi.

Fatemi, Y., Amouei, M. and Mousavi-Sabet, H. 2019. Updated checklist and geographical distribution of fishes in Kohgiluyeh and Boyer-Ahmad Province. Iranian Scientific Fisheries Journal, 28(5):111-119. In Farsi.

Fathabad, A. E., Tajik, H. and Shariatifar, N. 2019. Heavy metal concentration and health risk assessment of some species of fish, Rasht, Iran. Journal of Mazandaran University of Medical Sciences, 28(168):118-132. In Farsi.

Fathi, N. 2013. Study of survival and growth performance of kutum (*Rutilus frisii kutum*) fed by oil emulsion-enriched *Daphnia magna*. Renewable Natural Resources Research, 3(4):9-16. In Farsi.

Fathi, P., Ebrahimi, E. and Esmaeili, A. 2015. Choghakhor water quality assessment using WQS index. Journal of Animal Environment, 7(3):119-128. In Farsi.

Fathi, P., Ebrahimi, E., Mirghafari, N. and Esmaeili, A. 2016. The study of spatial and temporal changes of water quality in Choghakor wetland using water quality index (WQI). Journal of Aquatic Ecology, Hormozgan University, 5(3):41-50. In Farsi.

Fathi, S., Khanipour, A. A. and Fahimdejban, Y. 2014. Chemical composition and nutritional value of the freezing consolidated burgers (kilka-silver carp) during cold storage. Journal of Food Hygiene, 4(1):23-31.

Fathi, Z. and Ahmadifard, N. 2019. Effect of urban wastewater on fish community in the Saghez River, Kurdistan Province. Iranian Scientific Fisheries Journal, 28(4):117-128. In Farsi.

Fathi, Z. and Ahmadifard, N. 2020. Investigating the effect of urban wastewater on water quality in Saqez river using physicochemical factors and quality index. Journal of Wetland Ecobiology, 12(3):23-36. In Farsi.

Fathiazad, F., Afshar, J. and Maham, M. 2002. Study and comparison of anesthetic effect of clove oil and tricaine in *Cyprinus carpio*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella*. Pharmaceutical Sciences, 1:61-68.

Fayazi, J., Moradi, M., Rahimi, G., Ashtyani, R. and Galledari, H. 2006. Genetic differentiation and phylogenetic relationships among *Barbus xanthopterus* (Cyprinidae) populations in southwest of Iran using mitochondrial DNA markers. Pakistan Journal of Biological Sciences, 9(12):2249-2254.

Fazel, A., Ghorbani, R., Bahremand, A. and Salman Mahini, A. 2019. Influence of stream channel morphology and in-stream habitats on fish community in Golestan province streams. Journal of Applied Ichthyological Research, 7(3):17-30. In Farsi.

Fazel, A. M. and Tanimoto, S. 2012. Anzali Wetland Ecological Management Project in the Islamic Republic of Iran Project Completion Report. Department of Environment, Iran and Japan International Cooperation Agency. vi + 107 pp., 21 attachments.

Fazelan, Z., Hoseini, S. M., Yousefi, M., Khalili, M., Hoseinifar, S. H. and Van Doan, H. 2020. Effects of dietary eucalyptol administration on antioxidant and inflammatory genes in common carp (*Cyprinus carpio*) exposed to ambient copper. Aquaculture, 518:734988.

Fazelan, Z., Vatnikov, Y. A., Kulikov, E. V., Plushikov, V. G. and Yousefi, M. 2020. Effects of dietary ginger (*Zingiber officinale*) administration on growth performance and stress, immunological, and antioxidant responses of common carp (*Cyprinus carpio*) reared under high stocking density. Aquaculture, 518:734833.

Fazeli, F., Esmaili-Sari, A., Abdoli, A., Sohrabi, H. and van den Brink, P. J. 2015. Length-weight relationships of 14 fish species from Tajan River, southern Caspian Sea basin, Iran. Iranian Journal of Ichthyology, 2(4):299-301.

Fazeli, F., Pazira, A. and Maghsodlou, T. 2015. Age determination and growth of *Capoeta trutta* in Seymareh River. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 189.

Fazeli, F., Zaeri, Z., Pazira, A-R., Maghsoudloo, T. and Vatandoust, S. 2015. Life history traits of *Capoeta trutta* (Heckel, 1843) from Seymareh River, western Iran (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 2(4):280-286.

Fazilat, N., Vazirzadeh, A., Banaee, M. and Farhadi, A. 2017. Separate and combined effects of dimethoate pesticide and bio-fertilizer on the activity of enzymes involved in anaerobic pathway, neurotransmission and protein metabolism in common carp, *Cyprinus carpio* (Teleostei Cyprinidae). Iranian Journal of Ichthyology, 4(4):352-359.

Fazli, H. 2011. Biological studies of fishes (Clupeidae, *Rutilus frisii kutum*, *Liza auratus*, *Cyprinus carpio*, *Chalcalburnus chalcoides*, *Vimba vimba*, *Abramis brama*, *Sander lucioperca* & *Liza saliens*) of southern Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 98 pp. In Farsi.

Fazli, H. 2014. Species composition of bonyfish in the Iranian waters of the Caspian Sea during

1927-2013. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Fazli, H. 2016. Population dynamic of bony fishes in Iranian waters of the Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 60 pp. In Farsi.

Fazli, H. 2017. Assessment of *Mnemiopsis leidyi* on catch structure of fish in southern part of Caspian Sea. Journal of Fisheries Science and Technology, 5(4):111-127. In Farsi.

Fazli, H., Afraei Bandpei, M. A., Pourgholam, R. and Roohi, A. 2013. Long-term changes in fecundity of the kutum, *Rutilus frisii kutum* Kamensky, 1901, in the Caspian Sea (Osteichthyes: Cyprinidae). Zoology in the Middle East, 59(1):51-58.

Fazli, H. and Daryanabard, G. 2017. Study on catch spatial changes and classifying of beach seine cooperatives in Iranian coast of the Caspian Sea. Iranian Scientific Fisheries Journal, 26(2):61-68. In Farsi.

Fazli, H., Daryanabard, G., Abdolmaleki, S. and Bandani, G. A. 2013. Stock assessment of bony fishes in Iranian waters of the Caspian Sea (2007-2010). Final Report. Iranian Fisheries Research Organization, Tehran. 97 pp. In Farsi.

Fazli, H., Daryanabard, G., Naderi Jelodar, M., Mirzaei, R. and Hosseinpour, H. 2018. Growth and condition factor of *Capoeta damascina* in the Azad dam Lake and the Komasi River in Kurdistan Province, Iran. International Journal of Aquatic Biology, 6(6):307-313.

Fazli, H., Daryanabard, G., Naderi Jolodar, M. and Janbaz, A. A.2019. Changes in the condition factor and relative condition factor of *Rutilus kutum* in the eastern part of the Caspian Sea (Goharbaran). Journal of Marine Biology, 10(4):15-24. In Farsi.

Fazli, H., Daryanabard, G., Naderi Jolodar, M., Kor, D., Janbaz, A. and Afraei, M. A. 2018. Fish distribution and species composition in eastern part of the Caspian Sea (Goharbaran). Journal of Animal Environment, 9(4):255-262. In Farsi.

Fazli, H., Daryanabard, G., Salmanmahiny, A., Abdolmaleki, S., Bandani, G. and Afraei Bandpei, M. A. 2012. Fingerling release program, biomass trend and evolution of the condition factor of Caspian kutum during the 1991-2011 period. Cybium, 36(4):545-550.

Fazli, H. and Daryanabard, G. R. 2020. Stock enhancement and density-dependence of Caspian kutum (*Rutilus kutum* Kamensky, 1901) in Iranian waters of the Caspian Sea. International Journal of Aquatic Biology, 8(4):281-287.

Fazli, H., Daryanabard, G. R., Abdolmaleki, S. and Bandani, G. A. 2013. Stock management implication of Caspian kutum (*Rutilus frisii kutum* Kamensky, 1901) in Iranian waters of the Caspian Sea. Ecopersia, 1(2):179-190.

Fazli, H., Daryanabard, G. R., Janbaz, A., Mirzaei, R., Hosseinpour, H. and Vahedi, N. 2017. Age and growth of *Carassius auratus* (Heckel, 1843) in Azad dam Lake in Kordestan province, Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Fazli, H., Daryanabard, G. R., Janbaz, A., Mirzaei, R., Hosseinpour, H. and Vahedi, N. 2018. Some biological characteristics of *Carassius gibelio* (Bloch, 1782) (Teleostei: Cyprinidae) in the Azad dam Lake in western Iran. Iranian Journal of Ichthyology, 5(3):243-249.

Fazli, H., Daryanabard, G. R., Janbaz, A., Naderi, M., Mirzaei, R., Hosseinpour, H. and Vahedi, N. 2019. Age and growth of *Alburnus mossulensis* Heckel, 1843 in Azad Dam Reservoir and Komasi River in Kordestan Province, Iran. Iranian Journal of Fisheries Sciences, 18(4):672-683.

Fazli, H., Ghanghermeh, A. A. and Shahifar, R. 2017. Analysis of landings and environmental

variables time series from the Caspian Sea. Environmental Resources Research, 5(1):1-11.
Fazli, H., Kor, D. and Daryanabard, G. 2014. Spatial and temporal distribution of kutum (*Rutilus frisii kutum*, Kamensky 1901) in Iranian waters of the Caspian Sea. Iranian Scientific Fisheries Journal, 23(1):63-75. In Farsi.
Fazli, H., Kor, D., Daryanabard, G. and Tavakoli, M. 2014. Distribution and biodiversity of fishes in bottom trawl in Iranian part of the Caspian Sea. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Fazli, H., Kor, D., Tavakoli, M., Daryanabard, G. and Taghavi, H. 2013. Spatial-temporal distribution of common carp (*Cyprinus carpio*) in Iranian waters of the Caspian Sea. Renewable Natural Resources Research, 3(4):29-37. In Farsi.
Fazli, H., Nasrolahzadae, H., Porrang, N., Rohi, A. and Eslami, F. 2015. Effect of *Mnemiopsis leidy*i on biomass of five commercial fish species in the southern part of the Caspian Sea. Journal of Marine Biology, 7(1):23-34. In Farsi.
Fazli, H. and Parafkandeh Haghighy, F. 2016. Spatiotemporal abundance and diversity of bony fishes in beach seines in Iranian waters of the Caspian Sea. Journal of Fisheries Sciences and Technology, 5(3):109-120. In Farsi.
Fekrandish, H., Jamshidi, A. and Mahdavi, F. 2021. Effects of antioxidant and antibacterial coating sodium alginate_carrageenan with oil of savory (*Satureja khuzistanica*) to increase (*Mesopotamichthys sharpeyi*) burger maintenance during storage at refrigerator temperature (4 ± 1°C). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Fekrandish, H., Obeidi, R. and Ghanbari, F. 2018. Age structure and growth *of Cyprinion tenuiradius* (Heckel, 1843) (Cyprinidae), in southern Iran. Advances in Bioresearch, 9(2):160-165.
Fekri, N., Jamili, S., Ramin, M., Valipour, A. R. and Zamini, A. 2012. Effect of diazinon on stress factors and some blood insides (*sic*) of kutum (*Rutilus frissi* (*sic*) *kutum*). Journal of Animal Environment, 4(1):69-78. In Farsi.
Fendereski, F., Vogt, M., Payne, M. R., Lachkar, Z., Gruber, N., Salmanmahiny, A. and Hosseini, S. A. 2014. Biogeographic classification of the Caspian Sea. Biogeosciences, 11(22):6451-6470.
Ferraris, C. J., McGrouther, M. A. and Parkinson, K. L. 2000. A critical review of the types and putative types of southern Asian marine and freshwater fish species in the Australian Museum named by Francis Day. Records of the Australian Museum, 52(3):289-306.
Ferrier, R. W. 1996. A Journey to Persia. Jean Chardin’s Portrait of a Seventeenth-century Empire. I. B. Tauris Publishers, London. xiv + 193 pp.
Feylessoufi, E. 1959. Eaux souterraines, kanats et puits profonds en Iran. University Press, Tehran. 13 pp., 3 figs.
Fiedler, P. L. and Jain, S. K. (Eds.). 1992. Conservation Biology. The Theory and Practice of Nature Conservation and Management. Chapman and Hall, New York and London. xxix + 507 pp.
Filizadeh, Y. 2002. An ecological investigation into the excessive growth of *Azolla* in the Anzali Wetland and its control. Iranian Journal of Natural Resources, 55(1):65-80. In Farsi.
Filizadeh, Y. 2010. Possible impact of Caspian Sea level rise on the natural habitat of the Anzali

Lagoon in the north of Iran. Environmental Sciences, 7(3):91-101.
Filizadeh, Y., Ahmadi, H. and Zolfinejad, K. 2005. The feeding preference of grass carp (*Ctenopharyngodon idella* Val.) for ten aquatic plants. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', September 8-10, Shahr-e Kord, Iran (abstract).
Filizadeh, Y. and Khodaparast, S. H. 2005. Investigating effects of the excessive growth of aquatic plants on water quality in Anzali Lagoon, south-western Caspian Sea. Iranian Scientific Fisheries Journal, 13(4):139-150. In Farsi.
Firouz, E. 1968a. The sport fisheries of Iran. Paper presented at a Fishery Seminar, Tehran, 4-13 June 1968. MS.
Firouz, E. 1968b. The mordab of Pahlavi. Proceedings of a Technical Meeting on Wetland Conservation, Ankara-Bursa-Istanbul, 9 to 16 October 1967, International Union for Conservation of Nature and Natural Resources Publication, new series, 12:239-241.
Firouz, E. 1974. Environment Iran. The National Society for the Conservation of Natural Resources and Human Environment, Tehran. v + 55 pp.
Firouz, E. 1976. Environmental and nature conservation in Iran. Environmental Conservation, 3(1):33-42.
Firouz, E. 2000. A Guide to the Fauna of Iran. Iran University Press, Tehran. vi + 491 pp. In Farsi.
Firouz, E. 2005. The Complete Fauna of Iran. I. B. Tauris, London. xiv + 322 pp.
Firouz, E. and Harrington, F. A. 1976. Iran: Concepts of biotic community reservation. In: Proceedings of an International Meeting on ecological guidelines for the use of natural resources in the Middle East and South West Asia held at Persepolis, Iran 24-30 May 1975. International Union for the Conservation of Nature and Natural Resources Publications, new series, 34:147-169.
Firouz, E., Hassinger, J. D. and Ferguson, D. A. 1970. The Wildlife Parks and Protected Regions of Iran. Biological Conservation, 3(1):37-45.
Firouzbakhsh, F., Abedi, Z., Rahmani, H. and Khalesi, M. K. 2013. A comparative study of some blood factors in male and female Caspian kutum (*Rutilus frisii kutum*) broodstock from the southern basin of the Caspian Sea. Turkish Journal of Veterinary and Animal Sciences, 37(3):320-325.
Firouzbakhsh, F., Ebrahimzadeh Mousavi, H. A. and Khosravi, A. R. 2005. Isolation and identification of pathogenic and saprophytic fungi from gill lesions in cultivated cyprinids (common carp, silver carp and grass carp). Journal of the Faculty of Veterinary Medicine, University of Tehran, 60(1):15-19. In Farsi.
Firouzbakhsh, F. and Khosravi, A. R. 2010. Identification of Aspergillus species from cultivated warm water fish in Mazandaran Province in Iran. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).
Fishelson, L., Goren, M., van Vuren, J. and Manelis, R. 1996. Some aspects of the reproductive biology of *Barbus* spp., *Capoeta damascina* and their hybrids (Cyprinidae, Teleostei) in Israel. Hydrobiologia, 317(1):79-88.
Fisher, B. 1928. Irrigation systems of Persia. Geographical Review, 1928:302-306.
Fisher, W. B. (Ed.). 1968. The Cambridge History of Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. xix + 784 pp.
Fitt, R. L. 1953. Irrigation development in central Persia. Journal of the Royal Central Asian Society, 40(2):124-133.

Flandin, E. 1851. Voyage en Perse de mm. Eugène Flandin, peintre, et Pascal Coste, architecte.... pendant les années 1840 et 1841…. Gide et Jules Baudry, Paris. 2 volumes.
Floor, W. 2003. Agriculture in Qajar Iran. Mage, Washington. 692 pp.
Floor, W. 2007. Travels through northern Persia 1770-1774 by Samuel Gottlieb Gmelin. Translated and Annotated by Willem Floor. Mage Publishers, Washington, D.C. xxvii + 381 pp.
Foghi, M. 2004. The impact of drought on agriculture and fisheries in Iran, pp. 79-85. In: Petr, T. (Ed.). Fisheries in irrigation systems of arid Asia. Food and Agriculture Organization, Rome, Fisheries Technical Paper, 430:ix + 150 pp.
Foltz, R. C. 2001. Environmental initiatives in contemporary Iran. Central Asian Survey, 20(2):155-165.
Folyz, R. C. 2002. Iran’s water crisis: cultural, political, and ethical dimensions. Journal of Agriculture and Environmental Ethics, 15(4):357-380.
Food and Agriculture Organization. 1992. The Islamic Republic of Iran: Report of the aquaculture fact finding mission. Food and Agriculture Organization, Rome, Field Document, TCP/IRA/2251(F).
Food and Agriculture Organization, Fisheries Department. 1996. Fisheries and aquaculture in the Near East and North Africa: situation and outlook in 1996. Food and Agriculture Organization, Rome, Fisheries Circular, 919:37 pp.
Food and Agriculture Organization, Fisheries Department. 2006. State of world aquaculture 2006. Food and Agriculture Organization, Rome, Fisheries Technical Paper, 500:134 pp.
Food and Agriculture Organization, Fisheries Department, Rome, Italy and Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand. 1997. Survey and analysis of aquaculture development research priorities and capacities in Asia. Food and Agriculture Organization, Rome, Fisheries Circular, 930:viii + 263 pp.
Food and Agriculture Organization, Inland Water Resources and Aquaculture Service, Fishery Resources Division. 1995a. Review of the state of world fishery resources: inland capture fisheries. Food and Agriculture Organization, Rome, Fisheries Circular, 885:iii + 63 pp.
Food and Agriculture Organization, Inland Water Resources and Aquaculture Service, Fishery Resources Division. 1995b. Review of the state of world fishery resources: aquaculture. Food and Agriculture Organization, Rome, Fisheries Circular, 886:v + 127 pp.
Forey, P. L. and Young, S. V. T. 1999. Late Miocene fishes of the Emirate of Abu Dhabi, United Arab Emirates, pp. 120-135. In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.
Foroughi, F., Hosseini, H., Khaksar, R., Rashedi, H., Kamran, M., Shahraz, F., Komeili, R., Jalali, H., Fazeli Fard, R., Ghias Yeghaneh, A. and Azadnia, E. 2013. The protective effects of combined turmeric (*Curcuma longa*) and shallot (*Allium ascalonicum*) extracts on the shelf-life of silver carp (*Hypophthalmichthys molitrix*) paste stored at 18°. Journal of Nutrition Sciences and Food Technology, 8(1):197-207. In Farsi.
Foroughi, R., Esmaeili Sari, A. and Ghasempour, S. M. 2007. Correlation of length and weight with mercury concentration in different tissues of kutum roach (*Rutilus frisii kutum*) in central south of Caspian Sea. Iranian Scientific Fisheries Journal, 15(4):97-102. In Farsi.
Foroughi Abari, M., Radnezhad, H. and Sadeghi, M. 2015. Evaluation of drought selected

stations by Standardized Precipitation Index (SPI) on Wetland Gandoman. Journal of Materials Environmental Science, 6(10):2736-2749.

Forouhar Vajargah, M., Ghader Marzi, A., Hedayati, S. A. A. and Imanpour, M. R. 2016. Lethal effects of abamectin and pertilacholre (*sic*) poison on common carp (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 10(1):21-26. In Farsi.

Forouhar Vajargah, M., Ghafari Farsani, H., Shahbazi Naserabad, S. and Hedayati, A. 2019. Histopathological lesions in liver and gill of *Capoeta capoeta gracilis* exposed to butachlor. Journal of Experimental Animal Biology, 7(4):69-81. In Farsi.

Forouhar Vajargah, M. and Hedayati, A. 2017. Acute toxicity of butachlor to *Rutilus rutilus caspicus* and *Sander lucioperca* in vivo condition. Transylvanian Review of Systematical and Ecological Research,19(3):85-92.

Forouhar Vajargah, M. and Hedayati, S. A. 2019. Comparison on lethal toxicity of butachlor poison on common carp (*Cyprinus carpio*) and Caspian roach (*Rutilus kutum*). Journal of Experimental Animal Biology, 7(3):33-38. In Farsi.

Forouhar Vajargah, M. and Hedayati, S. A. 2021. Survey on water resources and watershed of Golestan province. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.

Forouhar Vajargah, M., Mohamadi Yalsuyi, A., Hedayati, A. and Faggio, C. 2018. Histopathological lesions and toxicity in common carp (*Cyprinus carpio* L. 1758) induced by copper nanoparticles. Microscopy Research and Technique, 81(7):724-729.

Forouhar Vajargah, M., Mohammadi Yalsuyi, A. and Rezaei, H. 2017. The effects of dietary natuzyme multi-enzyme on susceptibility to abamectin exposure in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 5(4):13-23. In Farsi.

Forouhar Vajargah, M., Sattari, M., Imanpour Namin, J. and Bibak, M. 2020a. Length-weight, length-length relationships and condition factor of *Rutilus kutum* (Actinopterygii: Cyprinidae) from the southern Caspian Sea, Iran. Journal of Animal Diversity, 2(2):56-61.

Forouhar Vajargah, M., Sattari, M., Imanpour Namin, J. and Bibak, M. 2020b. Length-weight relationship and some growth parameters of *Rutilus kutum* (Kaminski (*sic*) 1901) in the South Caspian Sea. Experimental Animal Biology, 9(1):11-20. In Farsi.

Forsatkar, M. N., Hedayatirad, M., Kookaram, K., Nematollahi, M. A. and Huang, W-B. 2014. Fluoxetine and diclofenac interaction on food intake in goldfish, *Carassius auratus*. International Journal of Aquatic Biology, 2(4):172-179.

Forsatkar, N., Kukaram, K. and Nematolahi, M. A. 2015. Effect of fluoxetine on food intake and feeding behavior of goldfish *Carassius auratus*. Iranian Scientific Fisheries Journal, 23(3):97-108. In Farsi.

Förster, H. 1976. Continental drift in Iran in relation to the Afar structures, pp. 182-190. In: Pilger, A. and Rosler, A. (Eds.). Proceedings of an International Symposium on the Afar Region and Related Rift Problems, held in Bad Bergzabern, F. R. Germany, 1-6 April 1974. Volume 2, Afar between continental and oceanic rifting. E. Schweizerbartsche Verlagsbuchhandlung, Stuttgart.

Fortescue, L. S. 1922. Military Report on Tehrān and adjacent Provinces of North-West Persia (including the Caspian Littoral). Superintendent Government Printing, Calcutta. iii + 553

pp., 17 pls., map.
Fortescue, L. S. 1924. The western Elburz and Persian Azerbaijan. Geographical Journal, 63(4):301-318.
Fotouhi, S., Mesbah, S. H. and Sadri, S. 2014. Identifying and analyzing drying risk matrix of Maharlou Wetland and its outcomes in the environment. Journal of Wetland Ecobiology, 6(2):43-54. In Farsi.
Fowler, H. W. 1956. Archaeological fishbones collected by Carleton S. Coon at Hotu, Iran. Bulletin of the Research Council of Israel, 5B:293-297.
Fowler, H. W. 1958. Some new taxonomic names of fishlike vertebrates. Notulae Naturae of the Academy of Natural Sciences of Philadelphia, 310:1-16.
Fowler, H. W. and Steinitz, H. 1956. Fishes from Cyprus, Iran, Iraq, Israel and Oman. Bulletin of the Research Council of Israel, 5B:260-292.
Fraser, J. B. 1825. Narrative of a Journey into Khorasan, in the years 1821 and 1822, including some account of the countries to the North-east of Persia; with remarks upon the national character, government, and resources of that kingdom. Longman, Hurst, Rees, Orme, Brown, and Green, London. xxvi + 623 pp., + 148 pp., map.
Fraser, J. B. 1834. An Historical and Descriptive Account of Persia, from the earliest ages to the present time: with a detailed view of its resources, government, population, natural history, and the character of its inhabitants, particularly of the wandering tribes; including a description of Afghanistan and Beloochistan. Oliver & Boyd, Edinburgh. 472 pp., 13 plates, map.
Freyhof, J. 2016. Redescription of *Garra elegans* (Günther, 1868), a poorly known species from the Tigris River drainage (Teleostei: Cyprinidae). Zootaxa, 4173(5):496-500.
Freyhof, J., Bergner, L. and Ford, M. 2020. Threatened Freshwater Fishes of the Mediterranean Basin Biodiversity Hotspot: Distribution, extinction risk and the impact of hydropower. EuroNatur and RiverWatch. i-viii + 1-348 pp.
Freyhof, J., Els, J., Feulner, G. R., Hamidan, N. A. and Krupp, F. 2020. Freshwater Fishes of the Arabian Peninsula. Motivate Media Group, Dubai, Abu Dhabi and London. 272 pp.
Freyhof, J., Hamidan, N. A., Feulner, G. R. and Harrison, I. 2015. The status and distribution of freshwater fishes of the Arabian Peninsula, pp. 16-29. In: Garcia, N. Harrison, I., Cox, N. and Tognelli, M. F. (Compilers). The Status and Distribution of Freshwater Biodiversity in the Arabian Peninsula. IUCN, Gland, Switzerland. xvi + 196 pp.
Freyhof, J. and Özuluğ, M. 2014. *Acanthobrama thisbeae*, a new species of bream from southern Anatolia, Turkey (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 25(1):1-10.
Freyhof, J., Pipoyan, S., Mustafayev, N., Ibrahimov, S., Japoshvili, B., Sedighi, O., Levin, B., Pashkov, A. and Turan, D. 2020. Freshwater fish and lampreys of the Caucasus, pp. 97-105. In: Zazanashvili, N., Garforth, M. and Bitsadze, M. (Eds.). Ecoregional Conservation Plan for the Caucasus, 2020 Edition: Supplementary Reports. World Wildlife Fund and KfW, Tbilisi.
Fricke, R., Bilecenoglu, M. and Sari, H. M. 2007. Annotated checklist of fish and lamprey species (Gnathostomata and Petromyzontomorphi) of Turkey, including a Red List of threatened and declining species. Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie), 706:169 pp.
Friend, P. F. 1999. Rivers of the Lower Baynunah Formation, Emirate of Abu Dhabi, United Arab Emirates, pp. 38-49.In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of

Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.

Froese, R. and Pauly, D. (Eds.). 1996. FishBase 96. Concepts, design and data sources. International Center for Living Aquatic Resources Management, Manila. xi + 179 pp., CD-ROM (www.fishbase.org/search.php).

G

Gabriel, A. 1938. The southern Lut and Iranian Baluchistan. Geographical Journal, 92(3):193-210.

Gabrielian, B. 1998. Remarks on biology of *Varicorhinus capoeta sevangi* (Cyprinidae) from Lake Sevan. Italian Journal of Zoology, 65 (supplement):229-230.

Gabrielyan, B. K. 1995. Investigation of stocks and production of the khramulya, *Varicorhinus capoeta sevangi* (Cyprinidae), of Lake Sevan. Journal of Ichthyology, 35(9):345-350.

Gabrielyan, B. K. 2001. An annotated checklist of freshwater fishes of Armenia. Naga, The ICLARM Quarterly, 24(3 & 4):23-29.

Gaffaroğlu, M. and Yüksel, E. 2004. Karyotype analysis of *Cyprinion macrostomus* Heckel, 1843 (Pisces: Cyprinidae). Gazi Üniversitesi Kirşehir Eğitim Fakültesi, 5(2):235-239. In Turkish.

Gaffaroglu, M., Yuksel, E. and Ráb, P. 2006. Note on the karyotype and NOR phenotype of leuciscine fish *Acanthobrama marmid* (Osteichthyes, Cyprinidae). Biologia, Bratislava, 61(2):207-209.

Gall, C. 2004. Seven-year drought. New York Times, 12 December 2004 (www.nytimes.com, downloaded 13 December 2004).

Gandlin, A. A., Mustafaev, N. D., Yakimov, A. V. and Levin, B. A. 2017. Updating the geographical range of Terek barbel *Barbus ciscaucasicus* Kessler, 1877 (Cyprinidae) using the cytochrome *b* molecular marker. Inland Water Biology, 10(1):115-119.

Gandomi, Y., Chegini, V. and Shadi, A. 2012. Habitat mapping of Golestan coasts (southeast Caspian Sea), Iran. World Journal of Fish and Marine Sciences, 4(2):121-124.

Gandomkar, H., Shekarabi, S. P. H., Abdolhay, H. A. and Nazari, S. 2020. Genetic structure of the *Capoeta aculeata* populations inferred from microsatellite DNA loci. Biodiversitas, 21(9):4565-4570.

Gandomkar, H., Shekerabi, S. P. H., Abdolhay, H. A., Nazari, S. and Shamsaei Mehrjan, M. 2021. Characterization of novel genotyping-by-sequencing (GBS)-based simple sequence repeats (SSRs) and their application for population genomics of *Capoeta aculeata* (Valenciennes, 1844). Molecular Biology Reports, doi:10.21203/rs.3.rs-514326/v1.

Ganjali, Z. 2013. Evaluation of some biochemical serum factors of anjak (Cyprinidae: *Schizocypris altidorsalis*) in Sistan area. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 68 (abstract).

Ganjali, Z., Esmaeili, H. R., Eagderi, S. and Ebrahmi, M. 2018. Exotic fishes in the inland waters of Iran: Opportunities and challenges. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Ganji, M. H. 1960. The climates of Iran. Bulletin de la Société de Géographie d'Égypte, 28:195-299.

Ganji, M. H. 1968. Climate, pp. 212-249. In: Fisher, W. B. (Ed.). The Cambridge History of

Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. xix + 784 pp.
Ganji, M. H. 1978. Post-glacial climatic changes on the Iranian Plateau, pp. 149-163. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.
Ganjidoust, H., Ayati, B., Khara, H., Khodaparast, S. H., Akbarzadeh, A., Ahmadzadeh Layeghi, T., Nezami, Sh. A. and Zolfinezhad, K. 2009. Investigation of environmental pollution in Shiah Keshim Wetland. Environmental Sciences, 6(3):117-122. In Farsi.
Ganjidoust, H., Rahimi, V., Khodadadi, A. and Yong, R. 2002. Modeling Sefidrood River of Iran in term of fishery. Second International Symposium on GIS/Spatial Analyses in Fishery and Aquatic Sciences, The University of Sussex, Brighton, 3rd-6th September, 2002 (title).
Gante, H. F. 2011. Diversification of circum-Mediterranean barbels, pp. 283-298. In: Grillo, O. and Venora, G. (Eds.). Changing Diversity in Changing Environment. IntechOpen, Rjeka, Croatia (www.intechopen.com).
García-Melo, J. E., García-Melo, L. J., García-Melo, J. D., Rojas-Briñez, D. K., Guevera, G. and Maldonado-Ocampo, J. A. 2019. Photafish system: An affordable device for fish photography in the wild. Zootaxa, 4554(1):141-172.
Garedaghi, Y. and Mohammdi Hefz Abad, M. 2012. A case-report of *Chalcalburnus chalcoides* parasitic infections to *Ligula intestinalis* in Saungar Dam of Gilan Province. Veterinary Clinical Pathology (Veterinary Journal Tabriz), 6(2)(22):1579-1582. In Farsi.
Gashti, G. Z. 2009. Evaluation of hand and machinery trimming used in the production of silver carp fillets. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 87 (abstract).
Gasmi, H. and Mirzaei, M. 2004. Sargi Azarbaycan Yerli Balixlari Araz va Gzluzan Zirhovzasinda. The Joint Agriculture and Natural Resources Symposium, Tabriz-Ganja, May 14-16, 2004. 3 pp.
Gäsowska, M. 1968. The biometric comparison of the bream *Abramis brama* (Linnaeus) (Teleostei, Cyprinidae) from Polish water with the bream from other European countries. Věstník československé Společnosti zoologické, 32(4):319-336.
Gäsowska, M. 1974. Biometric and ecological studies on the bleak, *Alburnus alburnus* (LINNAEUS) (Pisces, Cyprinidae) from different bodies of water in Poland, in connexion with the geographic variability of this species. Annales Zoologici, Warszawa, 31(4):373-405.
Geldiay, R. and Balık, S. 1996. Türkiye Tatlısu Balıkları. (Ders Kitabı). II. Baskı. Ege Üniversitesı Su Ürünleri Fakültesi Yayınları No: 46, Ders Kitabı Dizini No: 16, Ege Üniversitesı Basımevı, Bornova, Izmir. xviii + 532 pp., map.
Georgieveskiy, V. Y. 2001. A review and a critical analysis of the methods and results of the Caspian Sea level forecasts, developed for 5 to 10 years and 20 to 100 years time horizons. Caspian Environment Programme, TACIS (Technical Assistance to the Commonwealth of Independent States, European Union). 18 pp.
Gerailoo, H., Omidi, F., Hosseini Seyyed, A. and Sodagar, M. 2014. Evaluation of the ability of silver carp (*Hypophthalmichthys molitrix*) filtration in different algal densities *Scenedesmus quadricauda* (for biological control of aquatic ecosystems). Breeding and Aquaculture Sciences Quarterly, 1(1):101-110. In Farsi.
Gerami, M. H. 2016. Approximate pattern of Caspian kutum according to its movement behavioural in R. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of

Mashhad, 20-21 July 2016 (abstract).
Gerami, M. H., Abdollahi, D. and Patimar, R. 2013. Length-weight, length-length relationship and condition factor of *Garra rufa* in Cholvar River of Iran. World Journal of Fish and Marine Sciences, 5(4):358-361.
Gerami, M. H. and Dastbaz, M. 2013. Commercial fishing methods in Iran. World Journal of Fish and Marine Sciences, 5(1):63-70.
Gerasimov, I. P. 1978a. Ancient rivers in the deserts of Soviet Central Asia, pp. 319-334. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.
Gerasimov, I. P. 1978b. The past and future of the Aral and the Caspian seas, pp. 335-349. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.
Gerson, R. 1982. The Middle East: landforms of a planetary desert through environmental changes. Striae, Uppsala, 17:52-78.
Gerve'ei, H., Jamili, S., Mashinchian, A. and Rostami, M. 2008. Determination of LC50 and tissue lesions caused by aluminum sulfate at acidic pH on gills of roach (*Rutilus rutilus*). Journal of Environmental Science and Technology, 36(special issue).
GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 1997. Opportunistic settlers and the problem of the ctenophore *Mnemiopsis leidyi* invasion in the Black Sea. GESAMP Reports and Studies, 58:x + 84 pp.
Ghaderi Ramazi, F., Jahanbakhshi, A. and Soudagar, M. 2013. Hematological and biochemical changes in common carp (*Cyprinus carpio*) fed with corn gluten. Journal of Fisheries and Technology, 1(1):53-62. In Farsi.
Ghadiri, H. 2004. Salinization of Karun River in Iran by shallow groundwater and seawater encroachment. 6th International Conference on Hydro-Science and Engineering (ICHE-2004), National Center for Hydroscience and Engineering, The University of Mississippi, 9 pp.
Ghadiri, H. and Ghadiri, M. 2005. Marshlands of Mesopotamia and the rivers which feed them. Program & Abstracts, 8th International Riversymposium 2005, 6-9 September, Brisbane, Australia (abstract).
Ghadirnejad, H. 2010. State of the environment biodiversity and fisheries in the southern Caspian Sea. The International Conference on Biodiversity of the Aquatic Environment "Towards a Diverse and Sustainable World", 13-15 December 2010, Lattakia- Syria (title).
Ghafar Zadeh, H. R. and Honar Bakhsh, N. 2008. Economic consequences of lack of action against invasive *Mnemiopsis leidyi* in the Caspian Sea coasts. Journal of Environmental Science and Technology, 9(4)(35):117-127. In Farsi.
Ghafari, S. M. and Jamili S. 2010. Certain aspects of the reproductive biology of berzem (*Barbus pectoralis*) in Karoon River. Journal of Fisheries and Aquatic Science, 5(1):33-41.
Ghafari, T. and Falahatkar, B. 2015. The effect of age on reproductive indices of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 9(1):67-79. In Farsi.
Ghafari Farsani, H., Akbar Hedayati, S. A., Mansouri Chorehi, M., Rostamian, N. and Chaharde Baladehi, E. 2015. Study on liver histopathological changes of goldfish (*Carassius auratus*) during exposure to lethal and sub lethal concentrations of cadmium. Experimental Animal Biology, 3(4):9-16. In Farsi.

Ghafari Farsani, H., Rashidian, G., Narimanizad, F., Khodadadi, M. and Gerami, M. H. 2015. Histopathology and biochemical analysis of common carp (*Cyprinus carpio*) exposed to sublethal concentrations of Carboxin-thiram (Vitavax Thiram). Journal of Fisheries and Aquatic Sciences, 10(5):337-346.

Ghafoori, Z., Heidari, B. and Farzadfar, F. 2014. Variations of serum and mucus lysozyme activity and total protein content in the male and female Caspian kutum (*Rutilus frisii kutum*, Kamensky 1901) during reproductive period. Fish and Shellfish Immunology, 37(1):139-146.

Ghahaeri, M. 2003. Saving the Caspian Sea, first version: Iranian share, p. 76 (abstract). Global Threats to Large Lakes, 46th Conference on Great Lakes Research, 10th World Lake Conference, June 22-26, 2003, DePaul University, Chicago. iv + 304 pp.

Ghaheri, M., Baghal-Vayjooee, M. H. and Naziri, J. 1999. Lake Urmia, Iran: A summary review. International Journal of Salt Lake Research, 8(1):19-22.

Ghahraman, A. and Atar, F. 2003. Anzali Wetland in danger of death (an ecologic-floristic research). Journal of Environmental Studies, 28(Special issue):1-38. In Farsi.

Ghahraman, F. 1958. The right of use and economics of irrigation water in Iran. Ph.D. Thesis, University of Minnesota. xviii + 209 pp.

Ghahremanzadeh, Z., Bani, A., Imanpoor Namin, J. and Hallajian, A. 2014. Comparative investigation of kidney tubules of kutum, *Rutilus frisii kutum* in brackish water (Caspian Sea) and fresh water (Khoshkrood River). Journal of Animal Researches (Iranian Journal of Biology), 27(1):134-142. In Farsi.

Ghahremanzadeh, Z., Imanpoor Namin, J., Bani, A. and Hallajian, A. 2014. Cytological comparison of gill chloride cells and blood serum ion concentrations in kutum (*Rutilus frisii kutum*) spawners from brackish (Caspian Sea) and fresh water (Khoshkrood River) environments. Archives of Polish Fisheries, 22(3):189-196.

Ghaitaranpour, M., Poorbagher, H. and Eagderi, S. 2018. Effects of dam on habitat suitability index (*Barbus cyri*) in Shah River, Caspian Sea basin. Protection of Iranian Endemic Freshwater Fish Conference, Fisheries Department (University of Tehran) and Iranian Society of Ichthyology, 19 December 2018, Karaj, pp. 217-223. In Farsi.

Ghalandarzadeh, F., Rezaie Tavabe, K., Shirazi, R. H. S. M. and Kuchaksaraei, S. 2020. An investigation on heavy metal (cadmium, chromium, zinc) concentration changes in water and sediment, and assessing the biological value index (Z) in Karaj River. Journal of Fisheries (Iranian Journal of Natural Resources), 73(2):199-212. In Farsi.

Ghaleno, M. R. D., Sadoddin, A., Sheikh, V. and Sabouni, M. S. 2017. Optimal utilization of the Chanimeh water reservoirs in Sistan region of Iran using goal programming method. Ecopersia, 5(1):1641-1654.

Ghalenoei, M., Pazooki, J., Abdoli, A., Hassanzadeh Kiabi, B. and Golzarian, K. 2010. Morphometric and meristic study of *Garra rufa* populations in Tigris and Persian Gulf basins. Iranian Scientific Fisheries Journal, 19(3):107-118. In Farsi.

Ghanavi, H. R., Gonzalez, E. G. and Doadrio, I. 2016. Phylogenetic relationships of freshwater fishes of the genus *Capoeta* (Actinopterygii, Cyprinidae) in Iran. Ecology and Evolution, 6(22):8205-8222.

Ghanbari, M. and Jami, M. 2011. Threatened fishes of the world: Schizothorax zarudnyi Nikolskii, 1897. The 4th International Symposium on Stock Enhancement and Sea Ranching, 9th Asian Fisheries and Aquaculture Forum, Shanghai Ocean University, April 21 to 23, 2011 (abstract).

Ghanbari, M., Jami, M., Naghdi, M. and Shahriari Moghadam, M. 2009. The investigation of long-term effects of water pH changes on haematological parameters in fingerlings of common carp (*Cyprinus carpio* L.). Iranian Journal of Biology, 22(1):143-150. In Farsi.

Ghanbari, M., Jami, M., Shahraki, H. and Domig, K. J. 2019. Characterization of the gut microbiota in the anjak (*Schizocypris altidorsalis*), a native fish species of Iran. bioRxiv, doi:10.1101/735241.

Ghanbari, M., Rezaei, M., Soltani, M. and Shahhosseini, Gh. R. 2009. Production of bacteriocin by a novel *Bacillus* sp. strain RF 140, an intestinal bacterium of Caspian Frisian roach (*Rutilus frisii kutum*). Iranian Journal of Veterinary Research, Shiraz University, 10(3)(28):267-272.

Ghanbari, M., Shahraki, H., Kneifel, W. and Domig, K. J. 2017. A first insight into the intestinal microbiota of snow trout (*Schizothorax zarudnyi*). Symbiosis, 72(3):183-193

Ghanbary, K., Poria, M., Azari, H., Behrouz, M. and Ejraee, F. 2014. Some biological properties of *Chondrostoma regium* (Heckel, 1843) in Gamasiab River in Kermanshah Province, Iran. Advances in Bioresearch, 5(3):69-76.

Ghanbary, K., Poria, M., Nouri, F., Ejraee, F. and Poria, H. 2013. Interrelationships between morphometric variables and total weight in male fish *Chondrostoma regium* (Heckel, 1843) evaluated by path analysis in Ghamasiab river Kermanshah, Iran. International Journal of Biosciences, 2(12):120-127.

Ghane, A. 2013. The alien freshwater prawn, *Macrobrachium nipponense* (deHaan, 1849) in Iran: Advantages and disadvantages and ecological effects on Anzali Lagoon. Advanced Journal of Biological Sciences Research, 1(003):030-036.

Ghane, A. 2014. Benthic macroinvertebrates community structure in Zayandeh-rud River, Chahmahal va Bakhtiyari Province. Journal of Aquaculture Development, 7(4):57-65. In Farsi.

Ghane, A., Mirzajani, A., Abbasi, K., Khatib, S., Bagheri, S. and Sayyadrahim, M. 2018. Qualitative and quantitative study of benthic macroinvertebrates in Anzali wetland. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Ghane Sasansaraie, A. 2007. Limnological survey on the most important rivers in the Iranian southern coasts of the Caspian Sea in the Guilan Province with emphasize on the pollutants (Hevigh, Karkanrud and Shafarud rivers). Tehran, Iran, Iranian Fisheries Science Research Institute. 158 pp. In Farsi.

Ghanei Tehranei, M. 2016. The study of physical, chemical and biological Tagan and Sorkhrod River on time release fingerling *Rutilus frisii kutum*. Iranian Fisheries Science Research Institute, Tehran. 50 pp. In Farsi.

Ghanei Tehrani, M., Pourgholam, R., Farabi, S. M. V., Hassan Nasrollahzadeh Saravi, H. and Najafpour, Sh. 2015. Investigation on water physico-chemical characterization and identification of organochlorinated pesticides in Tajan River and Surkh Rud during the period of release of kutum (*Rutilus frisii kutum*) fingerlings. New Technologies in Aquaculture Development (Journal of Fisheries), 9(2):83-92. In Farsi.

Ghanemi, M. and Khodadadi, M. 2017. Effects of ovaprim administration on reproductive parameters of shirbot, *Barbus grypus*, Cyprinidae. Turkish Journal of Fisheries and Aquatic Sciences, 17(5):1025-1030.

Ghani, S., Maddah, S., Hedayati, A., Kakavand, F., Iri, A., Sanchooli, H. and Veisi, R. S. 2019. Effect of dietary enrichment of Padina algae (*Padina australis* Hauck) on serum immune

indices of common carp *Cyprinus carpio* in exposure to zinc oxide nanoparticle. Iranian Scientific Fisheries Journal, 28(5):121-129. In Farsi.

Ghaninejad, D., Moghim, M., Sayyad Bourani, M. and Abdulmaleki, S. 2001. Stock enhancement evaluation. Bony Fishes Research Station, Rasht. 98 pp. In Farsi.

Ghaninezhad, D. and Abd Almalaki, Sh. 2009. Sustainable exploitation of the bony fishes in Iranian coastal waters of the Caspian Sea: necessities and requirements. Iranian Scientific Fisheries Journal, 18(2):105-118. In Farsi.

Ghara, K., Moradi, M., Ghorbani, S. A., Amiri, A. and Parvaneh Moghadam, D. 2007. An investigation on the growth and survival of *Rutilus frisii kutum* in geomembrane tanks. Iranian Scientific Fisheries Journal, 16(3):155-158. In Farsi.

Gharache, M. 2008. On the biology of *Capoeta damascina* in qanat of southern Isfahan Province, central Iran. B.Sc. Project, Gonbad Higher Education Centre, Gonbad, Iran. 75 pp.

Gharache, M. H. and Paighambary, S. Y. 2012. The comparison of some spermatological parameters of kutum brood stock (*Rutilus frisii kutum*, Kamensky 1901) captured by beach seine and gill net. Journal of Marine Sciences and Technology, 10(2):4-9. In Farsi.

Gharache, M. H., Paighambary, S. Y. and Golpour, A. 2014. Hematological and biochemical indices of kutum *Rutilus frisii kutum*, associated with capture methods. Comparative Clinical Pathology, 23(4):979-982.

Gharacheh, M. 2018. Effects of electrofishing on stress response of wild carp (*Cyprinus carpio* L.). Comparative Clinical Pathology, 27(4):817-820.

Gharaei, A. 2012. Morphometric and meristic studies of snow trout *Schizothorax zarudnyi* (Nikolskii, 1897) as a threatened endemic fish. World Journal of Fish and Marine Sciences, 4(4):426-429.

Gharaei, A. 2016. Effect of diluent solutions on the fertilization of snow trout (*Schizothorax zarudnyi*). Journal of Aquaculture Sciences, 3(1):16-30. In Farsi.

Gharaei, A., Bazmani, M., Mirdar Harijani, J. and Khosravanizadeh, A. 2020. Effect of indomethacin on the oxidative stress of *Cyprinus carpio* using of biomarkers. Journal of Applied Ichthyological Research, 8(2):60-66. In Farsi.

Gharaei, A. and Esmaili-Sari, A. 2008. LC_{50} and bioaccumulation of mercury chloride ($HgCl_2$) in *Rutilus frisii* (Nordmann, 1840). Journal of Applied Ichthyology, 24(6):705-706.

Gharaei, A., Esmaili Sari, A., Shahriari Moghadam, M., Nazari, R. M. and Karami, R. 2006. Acute LC50 and bioconcentration of mercury chloride in *Rutilus frisii kutum*. Iranian Scientific Fisheries Journal, 15(2):101-108. In Farsi.

Gharaei, A., Ghaffari, M., Raeisi Azizi, M. and Harijani, J. M. 2014. Investigation of *Schizothorax zarudnyi* and *Schizocypris altidorsalis* relationship with some of Barbinae species in Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Gharaei, A., Rahdari, A. and Ghaffari, M. 2010. *Schizothorax zarudnyi* as a potential species for aquaculture. Aqua 2010, Proceedings of the Global Conference on Aquaculture 2010, Farming the Waters for People and Food, Phuket, Thailand, 22-25 September 2010, pp. 119-120 (paper).

Gharaei, A., Rahdari, A. and Ghaffari, M. 2011a. Artificial reproduction of *Schizothorax zarudnyi* using synthetic hormones. Journal of Marine Sciences and Technology, 10(1):1-12. In Farsi

Gharaei, A., Rahdari, A. and Ghaffari, M. 2011b. Induced spawning of *Schizothorax zarudnyi* (Cyprinidae) by using synthetic hormones (ovaprim and HCG). World Journal of Fish

and Marine Sciences, 3(6):518-522.
Gharavi, B., Hoseini, S. M. and Ghelichpour, M. 2018. An insight on health consequences of imported ornamental fish on native fish species in Iran. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Gharedaashi, E., Imanpoor, M. R. and Taghizadeh, V. 2015. Effect of heavy metals (copper and lead) on survival, behavior and growth performance of Caspian Sea kutum (*Rutilus frisii kutum*). Journal of Animal Environment, 7(1):305-310. In Farsi.
Gharedaashi, E., Nekoubin, H., Imanpour, M. R., Asgharimoghadam, A. and Larijani, M. 2012. Acute toxicity of lead nitrate and copper sulphate in Caspian roach (*Rutilus rutilus caspicus*). Journal of Fisheries International, 7(1):6-9.
Gharzi, A., Ebrahimi Bagheban, A. and Abbasi, M. 2011. Histomorphometry of urogenital system in Iranian cave barb (*Iranocypris typhlops*). Journal of Animal Environment, 3(3):45-54. In Farsi.
Ghasemi, A., Keyvanshokooh, S., Shahriari-Moghadam, M., Khara, H. and Sourinejad, I. 2007. Genetic comparison of Iranian and Azeri populations of the oriental bream *Abramis brama orientalis* (Berg) using microsatellites. Aquaculture Research, 38(16):1742-1746.
Ghasemi, A., Mazandarani, M., Sudagar, M. and Hoseini, S. M. 2017. Dietary effects of turmeric (*Curcuma longa*) on reducing liver and kidney damage caused by exposure to copper sulfate in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(2):138-147. In Farsi.
Ghasemi, H. 1998. Recognition of endemic fishes in East Azerbaijan. Research Centre of Natural Resources and Domesticated Animals of East Azerbaijan. 105 pp. In Farsi.
Ghasemi, H. 2002. Identification of *Barbus* species in the east Azarbaijan rivers. Iranian Scientific Fisheries Journal, 11(3):81-90. In Farsi.
Ghasemi, H., Jouladeh Roudbar, A., Eagderi, S., Abbasi, K., Vatandoust, S. and Esmaeili, H. R. 2015. Ichthyofauna of Urmia basin: Taxonomic diversity, distribution and conservation. Iranian Journal of Ichthyology, 2(3):177-193.
Ghasemi, H and Mustafayev, Q. T. 2008. Identification of fishes and some ecological parameters of Aras River (eastern side of Azerbaijan Province). Iranian Scientific Fisheries Journal, 17(3):121-132. In Farsi.
Ghasemi, M. and Kalteh, H. 2015. Investigation of the reasons for illegal hunting and fishing in Mazandaran and Golastan provinces, and presentation of legal ways to reduce violation. Journal of Environmental Science and Technology, 16(Special Issue):391-400. In Farsi.
Ghasemi, M., Eynizadeh, Z. and Haghighi Karsidian, S. 2021. Prevention and control strategies and laboratory procedures for diagnosis of viral diseases of common carp (*Cyprinus carpio*). Advanced Aquaculture Sciences Journal, 4(4):59-73. In Farsi.
Ghasemi, M., Zamani, H., Hosseini, S. M., Haghighi Karsidani, S. and Bergmann, S. M. 2014. Caspian white fish (*Rutilus frisii kutum*) as a host for spring viraemia of carp virus. Veterinary Microbiology, 170(3-4):408-413.
Ghasemi, S. 2010. Population dynamics and stock assessment of the common carp (*Cyprinus carpio*) in Iranian waters of the Caspian Sea. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 105 pp. In Farsi.
Ghasemi Rezvani, N., Safaie, M. and Saraji, F. 2020. Diet composition of *Cyprinion watsoni* (Day, 1872) in the Marm Cascade (Hormozgan Province). Journal of Animal Environment, 12(4):285-292. In Farsi.

Ghasempour Dehagani, P., Javaheri Baboli, M., Ziaei Nejad, S., Taghavi Moghadam, A. and Pourfahadi, M. 2013. Effects of Biomin®Imbo synbiotic as dietary supplementation on growth, survival and gut bacteria flora of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 7(3):43-52. In Farsi.

Ghasempouri, S. M. and Esmaili Sari, A. 2002. Determination of total hydrocarbons in water and sediment of Gomishan Wetland. Iranian Journal of Marine Sciences, 1(1):61-67, 80. In Farsi.

Ghasemzadeh-Sarcheshmeh, K., Mousavi-Sabet, H., Sattari, M., Vatandoust, S. and Ahmadnezhad, M. 2018. Age, growth, sex ratio, spawning season and fecundity of *Capoeta razii* from Sefid River in the southern Caspian Sea basin. Iranian Journal of Ichthyology, 5(4):267-276.

Ghasemzadeh-Sarcheshmeh, K., Sattari, M., Mousavi-Sabet, H., Vatandoust, S. and Ahmadnejad, M. 2015. Length-length and length-weight relationships of siah mahi (*Capoeta capoeta*) in downstream of Sefidroud River (the southern Caspian Sea basin). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 60.

Ghasoodlu, S., Pourashouri, P. and Shabanpour, B. 2017. Enhancement of the nutritional status and quality of enriched silver carp (*Hypophthalmichthys molitrix*) sausage by fish oil. Journal of Fisheries Science and Technology, 6(1):101-117. In Farsi.

Ghassemi, F. 1979. Mathematical model application in ground-water studies of Iran. Ground Water, 17(4):359-365.

Ghassemzadeh, F. 2004. Limnological studies of Bazangan Lake, northeast Iran. Ecological Society of America, 2004 Annual Meeting, Portland, Oregon (abstract).

Ghassemzadeh, F. and Madjdzadeh, S. M. 1996. Identification of fishes of Radkan and Frizy rivers in Khorasan province, p. 52 (abstract). The Fifth Iranian Biology Conference, Tabriz University.

Ghazilou, A. and Elder, M. P. 2015. The irony of harming fish as part of Iran's *Nowrouz*. Journal of Animal Ethics, 5(1):1-4.

Gheisvandi, N., Hajimoradloo, A. and Ghorbani, R. 2014. Effect of salinity as environmental factors on growth and intestine morphology of Caspian whitefish (Cyprinidae: *Rutilus frisii kutum*). Journal of Utilization and Cultivation of Aquatics, 3(2):99-110. In Farsi.

Gheisvandi, N., Hajimoradloo, A., Ghorbani, R. and Hoseinifar, S. H. 2015. The effects of gradual or abrupt changes in salinity on digestive enzymes activity of Caspian kutum, *Rutilus kutum* (Kamensky, 1901) larvae. Journal of Applied Ichthyology, 31(6):1107-1112.

Gheisvandi, N., Hajimoradloo, A. and Hoseinifar, S. H. 2014. The effect of water temperature on food transit time and digestive enzymes activity in Caspian kutum (*Rutilus kutum*) larvae. International Journal of Aquatic Biology, 2(3):138-146.

Ghelich, A. and Sheykhi, J. 2014. Comparison of the chemical composition and fatty acids profile of wild carp (*Cyprinus carpio*), farmed carp and wild farmed carp. Journal of Marine Biology, 5(20):31-44. In Farsi.

Ghelichi, A., Akrami, R., Bandani, Gh. and Jorjani, S. 2010. Reproduction biology of female common carp (*Cyprinus carpio*) in southeast of the Caspian Sea (Miankale Fishing Station). Journal of Fisheries (Iranian Journal of Natural Resources), 63(3):197-207. In Farsi.

Ghelichi, A., Akrami, R., Bandani, Gh. A. and Jorjani, S. 2011. Comparison of oocyte

development of common carp (*Cyprinus carpio*) and grey mullet (*Mugil cephalus*). Journal of Biology Science, 4(4)(series no. 15):69-81. In Farsi.
Ghelichi, A., Jafari, M. and Kamali Sanzighi, M. 2016. Planktonic flora and the role of it on yield of silver carp (*Hypophthalmichthys molitrix*) in warm water fish pond. Journal of Aquaculture Development, 10(4):91-102. In Farsi.
Ghelichi, A., Jorjani, S., Alami, S. and Shamloofar, M. 2015. Comparison of chemical composition and fatty acids profile of wild carp (*Cyprinus carpio*) in natural and cultivated environments. New Technologies in Aquaculture Development (Journal of Fisheries), 9(2):73-82. In Farsi.
Ghelichi, A., Jorjani, S. and Salmani, Y. 2013. Effects of lidocaine on water quality and hematological parameters in simulated transportation of common carp (*Cyprinus carpio*). Journal of Fisheries Science and Technology, 2(2):33-46. In Farsi.
Ghelichpour, M, 2010. Genetic diversity study *Cyprinus carpio* fish in the southern shores of the Caspian using microsatellite mark. M.Sc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. In Farsi.
Ghelichpour, M. 2014. Acute effect of copper exposure on serum biochemical characteristics of common carp (*Cyprinus carpio* L.). International Journal of Aquatic Biology, 2(3):124-128.
Ghelichpour, M. 2018. The application of microsatellite and mtDNA markers in the investigation of fish population genetics. Journal of Utilization and Cultivation of Aquatics, 6(4):33-40. In Farsi.
Ghelichpour, M. and Eagderi, S. 2012. Effect of formalin treatment on saltwater tolerance in Caspian roach (*Rutilus rutilus caspicus*). International Journal of Applied and Basic Sciences, 3(5):1027-1031.
Ghelichpour, M., Rajabiesterabadi, H. and Hoseini, S. M. 2016. Gill histopathological characteristics of Caspian roach (*Rutilus rutilus caspicus*) fingerlings treated with potassium permanganate and formalin. Aquaculture Research, 47(1):276-282.
Ghelichpour, M., Shabani, A. and Shabanpour, B. 2011. Genetic diversity of the two populations of common carp (*Cyprinus carpio*) in Gharahsu and Anzali regions using eight microsatellite markers. Journal of Taxonomy and Biosystematics, 2(5):39-48.
Ghelichpour, M., Shabani, A. and Shabanpour, B. 2013. Microsatellite variations and genetic structure of common carp (*Cyprinus carpio*) populations in Gomishan Bay and Gorganroud River (southeast of the Caspian Sea). International Journal of Aquatic Biology, 1(1):22-27.
Ghelichpour, M. and Taheri Mirghaed, A. 2018. Heat shock protein gene expression in common carp (*Cyprinus carpio*) exposed to indoxacarb pesticide. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Ghelichpour, M., Taheri Mirghaed, A., Hoseini, S. M. and Perez Jimenez, A. 2020. Plasma antioxidant and hepatic enzymes activity, thyroid hormones alterations and health status of liver tissue in common carp (*Cyprinus carpio*) exposed to lufenuron. Aquaculture, 516:734634.
Ghenaat Parast, A. 1993. Mass production of Caspian bream fingerlings. Abzeeyan, Tehran, 4(8):13-16, II. In Farsi.
Gheshlaghi, P., Vahabnezhad, A. and Taghavi Motlagh, S. A. 2012. Growth parameters, mortality rates, yield per recruit, biomass, and MSY of *Rutilus frisii kutum*, using length

frequency analysis in the southern parts of the Caspian Sea. Iranian Journal of Fisheries Sciences, 11(1):48-62, V.

Ghiasi, F. 2006. Effect of sub-lethal concentration of cadmium on the level of lysozyme in serum of common carp *Cyprinus carpio*. World Aquaculture Society, Aqua 2006, May 9-13, Florence, Italy (abstract).

Ghiasi, F. and Mirzargar, S. S. 2005. Effect of sub-lethal concentration on the level of lysozyme in serum of common carp (*Cyprinus carpio*). Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Ghiasi, F. and Mirzagar, S. S. 2006. Effect of sub-lethal concentration of cadmium on the level of lysozyme in serum of common carp *Cyprinus carpio*. World Aquaculture Society, Aqua 2006, May 9-13. Florence, Italy (abstract).

Ghiasi, F. and Mirzagar, S. S. 2015. Pathological effects of cadmium and efficiency of natural zeolite, *Clinoptilolite*, to reduce the cadmium toxicity in common carp and its ability to remove cadmium from contaminated water. Research Journal for Veterinary Practitioners, 3(2):36-40.

Ghiasi, F., Mirzagar, S. S., Badakhshan, H. and Salar Amoli, J. 2011. Influence of Iranian natural zeolite on accumulation of cadmium in *Cyprinus carpio* tissues following exposure to low concentration of cadmium. Asian Journal of Animal and Veterinary Advances, 6(6):636-641.

Ghiasi, F., Mirzagar, S. S., Badakhshan, H. and Shamsi, S. 2010. Effects of low concentration of cadmium on the levels of lysozyme in serum, leukocyte count and phagocytic index in *Cyprinus carpio* under the wintering conditions. Journal of Fisheries and Aquatic Sciences 5(2):113-119.

Ghiasi, F., Mirzargar, S. S., Salaramoli, J., Bahonar, A. and Ebrahimzadeh Mousavi, H. A. 2010. Study on hematology and serum biochemistry of common carp (*Cyprinus carpio*) after low cadmium concentration exposure. Journal of Veterinary Research, 65(1):61-66. In Farsi.

Ghiasi, M. 2014. Quantity evaluation and identification of pathogenic bacteria in water pond and cultivated Cyprinid fish enrichment by natural (cow dung) and chemical fertilizer. Iranian Fisheries Science Research Institute, Tehran. 47 pp. In Farsi.

Ghiasi, M., Pourgholam, R., Nasrolazadeh, H., Zahedi, A. and Binaii, M. 2014. Comparison of microbial flora and physicochemical parameters in cyprinid pond fertilized with cow dung and chemical fertilizer. Journal of Aquaculture Development, 7(4):67-76. In Farsi.

Ghiasi, M., Shokri, H., Binaii, M., Farabi, S. M. V. and Saeedi, A. A. 2012. Identification and incidence comparison of isolated fungi from Caspian kutum (*Rutilus frisii kutum*) eggs in Mazandaran Province. Journal of Aquaculture Development, 6(1):79-90. In Farsi.

Ghiasi, M., Solaymani, N., Shojaei, L. and Binaii, M. 2020. Evaluation of some hematological and sero-immunological parameters of common carp (*Cyprinus carpio*) during of overwintering. Journal of Aquaculture Development, 14(1):81-91. In Farsi.

Ghiasi, S. and Falahatkar, B. 2015. Changes of growth, food intake and cortisol plasma in juvenile carp (*Cyprinus carpio*) following cortisol injection. Iranian Scientific Fisheries Journal, 24(2):1-13. In Farsi.

Ghiasvand, Z., Changizi, R., Shamloofar, M. and Parsafar, M. 2017. Effects of garlic powder (*Allium sativum*) on the growth, survival, body composition and salinity resistance rate of fry kutum (*Rutilus frisii kutum*). Journal of Experimental Animal Biology, 6(2):75-84.

In Farsi.
Ghobadi, Sh. 2004. Comparative study on effects of LHRH and dopamine antagonists (Piomozide) on sexual maturation in common carp (*Cyprinus carpio*). M.Sc. Thesis, Islamic University of Lahijan, Iran. 60 pp.
Ghobadi, Sh., Tavakoli, H. and Mojazi Amiri, B. 2015. Effects of probiotic bactocell additives on the growth indices and body composition of juvenile common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 8(4):77-87. In Farsi.
Ghodrati, A. R., Sobh Zahedi, Sh. and Dadashi, M. A. 2007. Investigation on industrial pollution of Zarjub River - Rasht City - Guilan Province. Iranian Journal of Natural Resources, 60(1):213-224. In Farsi.
Ghodrati Shojaei, M., Taghavi Motlagh, S. A., Sourinejad, I., Taheri Mirghaed, A. and Noori Dafrazi, R. 2012. Analysis of fishing trend and prediction of fisheries potential based on catch analysis (case study: the Caspian Sea). Journal of Aquatic Ecology, Hormozgan University, 1(4):1-16. In Farsi.
Ghofleh Marammazi, J. 2000. Feeding and spawning characters of *Barbus grypus* Heckel, 1843 in Khouzestan water bodies. Iranian Scientific Fisheries Journal, 9(3):67-80. In Farsi.
Ghojoghi, A., Azizi, S., Namvar, F. and Patimar, R. 2017. Investigation of some growth parameters of *Carassius gibelio* (Bloch, 1782) in the bony fish culture reservoirs of Sijaval - southeastern Caspian Sea. Breeding and Aquaculture Sciences Quarterly, 4(12):33-44. In Farsi.
Ghojoghi, A., Patimar, R., Golzarianpour, K. and Bahalkeh, R. 2018. Investigation of some life history traits of *Alburnoides eichwaldii* (De Filippii, 1863) from the Googgol River, Gorgan River basin. Journal of Animal Environment, 10(1):137-144. In Farsi.
Ghojoghi, A., Patimar, R., Jafaryan, H. and Golzarianpour, K. 2017. Age and growth of *Alburnoides* cf. *tabarestanensis* (Teleostei: Cyprinidae) in the Zav Stream, southeastern Caspian Sea basin. Iranian Journal of Ichthyology, 4(4):331-339.
Ghojoghi, A., Patimar, R., Jafaryan, H. and Golzarianpour, K. 2019. Investigation of morphological variation of *Alburnoides cf. tabarestanensis* in Gorganroad (*sic*) basin. Shil Journal, 6(4):166-177. In Farsi.
Ghojoghi, F. 2015. Comparison of caudal skeleton between three populations of *Rutilus rutilus caspicus* from southern Caspian Sea. Advances in Environmental Biology, 9(2):651-654.
Ghojoghi, F. and Eagderi, S. 2014. Comparison of morphological characters in Turkmenian and Kura varieties of Caspian roach (*Rutilus rutilus caspicus*, Yakovlev, 1870) using geometric morphometric approach. Journal of Fisheries, 8(2):89-96. In Farsi.
Ghojoghi, F., Eagderi, S. and Nasri, M. 2018. Body shape comparison of kutum fish (*Rutilus kutum* (Kamensky, 1901) from southern Caspian Sea using geometric morphometric method. Journal of Aquaculture Development, 12(1):63-73. In Farsi.
Ghojoghi, F., Esfaniani, M. and Eagderi, S. 2014. Morphologic comparison of kutum (*Rutilus kutum* Kamenskii, 1901) populations in southern Caspian Sea coasts using geometric morphometric approach. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Ghojoghi, F., Kamali, A. Gh., Eagderi, S., Soltani, M. and Hashemzadeh Segherloo, I. 2014a. Morphological variation among the Caspian roach (*Rutilus rutilus caspicus*) populations from the southern Caspian Sea using geometric morphometrics technique. Bulletin of Environment, Pharmacology and Life Sciences, 3(special issue III):105-111.
Ghojoghi, F., Kamali, A. Gh., Eagderi, S., Soltani, M. and Hashemzadeh Segherloo, I. 2014b.

Study of osteological characteristics of Caspian roach (*Rutilus rutilus caspicus*). Journal of Fisheries, 7(4)(28):45-54. In Farsi.

Gholami, A., Vafakhah, M. and Najafpour, Sh. 2013. A study on the effects of Lar Dam construction in hydraulic fluctuation and suspended sediment load on aquatic fauna of Haraz River. New Technologies in Aquaculture Development (Journal of Fisheries), 7(3):41-50. In Farsi.

Gholami, F., Tajari, M., Yosef Nejad, S., Shahkar, E., Kolangi Miandare, H. and Azimi, A. 2013. Examination of some biochemical factors of blood serum in common carp (*Cyprinus carpio*) fingerlings at different levels of salinity. Journal of Fisheries, 7(1):37-44. In Farsi.

Gholami, M. 2010. Effects of n-3 HUFA enriched *Daphnia magna* on growth, survival, stress resistance and fatty acid composition of white fish fry (*Rutilus frisii kutum*). Journal of Fisheries and Aquatic Science, 5(1):49-55.

Gholami, M. and Falahi, M. 2008. Assessment of individual and mixed amounts of transmission of heavy metals (Cu, Cd) and (LAS) detergent to *Rutilus frisii kutum* food chain. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 2(4):15-21. In Farsi.

Gholami, M., Fatemi, S. M. R., Falahi, M., Esmaili, A. and Mashinchiyan, A. 2010. Effects of heavy metals (copper and cadmium) and detergent (LAS) on white fish fry *Rutilus frisii* Kutum (*sic*). Research Journal of Environmental Toxicology, 4(4):231-236.

Gholami, M., Fatemi, S. M. R., Falahi, M., Esmailisari, A. and Mashinchiyan, A. 2007. Influence individual and mixed heavy metals (Zn, Pb) and detergent (LAS) on the mortality white fish (*Rutilus frisii kutum*) of Caspian Sea. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 1(2):13-19. In Farsi.

Gholami, M. and Shapoori, M. 2017. Identification of species composition of fish in the Zarivar Lake (Kurdistan Province of Iran). Open Journal of Marine Science, 7(1):205-210.

Gholami, M. H., Mokhayer, B., Bozorgnia, A. and Hosseinzadeh Sahafi, H. 2009. Prevalence and intensity of parasitic infection from (*Leuciscus cephalus*) and (*Capoeta capoeta gracilis*) of the Neka River. Journal of Marine Science and Technology Research, 4(3):59-66. In Farsi.

Gholami, R., Davoodi, R., Oujifard, A. and Nooryazdan, H. 2016. The effect of *Azadirachtin* (*sic*) *indica* on a number of growth parameters, survival, and gill tissue of juvenile grass carp (*Ctenopharyngodon idella*). Journal of Aquatic Ecology, Hormozgan University, 5(4):98-107. In Farsi.

Gholami, S. J., Azaritakami, G., Gholami, S. J., Khoshnodifar, Kh., Shiri, N. and Haghi Vayghan, A. 2010. Evaluation of the effects of pike and fish polyculture integrated to rice culture. 16th Iranian Veterinary Congress, 27-29 April 2010, Tehran.

Gholami, V. 2021. Exploitation of water resources, a challenge for the fishes of the southern Caspian Sea basin (water structures, sand mines, and environmental water requirement). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Gholami, Z., Taghi Rahimi, M., Kia, E. B., Esmaeili, H. R. and Mobedi, I. 2014. *Capoeta damascina* (Valenciennes, 1842), a new host of *Contracaecum* sp. and *Capillaria* sp. (Nematoda) from the Kor River basin, southwestern Iran. Asian Pacific Journal of Tropical Biomedicine, 4(supplement 1):S139-S142.

Gholami SeyedKolaei, S. J., Shiri, N., Mirvaghefi, A., Rafiee, G. and Makhdomi, C. 2013. Toxicity evaluation of malathion, carbaryle and glyphosate in common carp fingerlings (*Cyprinus carpio* Linnaeus, 1758). Journal of Veterinary Research, 68(3):257-267. In Farsi.

Gholamifard, A. 2017. Preliminary study on the ichthyofauna of Mohr County (Persian Gulf basin) in southern Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Gholamifard, A. 2018a. Fish and fishing in the artworks of ancient Persia. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Gholamifard, A. 2018b. Wetlands of Fars Province: Ichthyodiversity and their conservation threats. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Gholamifard, A., Akhlaghi, M., Modares Mousavi, S. M. and Esmaeili, H. R. 2010. First report of Papillomatosis in two species of Cyprinidae: *Cyprinion tenuiradius* Heckel, 1849 and *Cyprinion macrostomum* Heckel, 1843. 16th National and 4th International Conference of Biology, Ferdowsi University of Mashhad, Mashhad, Iran, 14-16 September 2010 (abstract).

Gholamifard, A., Esmaeili, H. R. and Rastegar-Pouyani, N. 2015. A noteworthy record of translocation for *Emys orbicularis persica*, Eichwald 1831, in southern Iran. Amphibian and Reptile Conservation, 9(1):49-53.

Gholamifard, A. and Kafaei, S. 2017. Negative effects of exotic fish farming on the native ichthyofauna and herpetofauna of the Maharlu Lake basin, southern Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Gholamifard, A. and Kafaei, S. 2021. Investigation of ichthyodiversity and their conservation threats in the Cheshmeh Gomban wetlands (Kor River Basin), Fars Province. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.

Gholamifard, A., Monsefi, M. and Esmaeili, H. R. 2012. Gonad histology of the endemic cyprinid *Cyprinion tenuiradius* Heckel, 1849 from southern Iran. The 17th National and 5th International Iranian Biology Conference, Shahid Bahonar University, Kerman, 4-6 September 2012 (abstract).

Gholamifard, A., Monsefi, M. and Esmaeili, H. R. 2017. Histomorphometrical study of gonads in the endemic cyprinid fish, *Cyprinion tenuiradius* Heckel, 1847 (Cypriniformes: Cyprinidae). Iranian Journal of Fisheries Sciences, 16(2):477-493.

Gholamifard, A. and Vatandoust, S. 2017. Tracking the ichthyodiversity of the Tigris River basin in the ancient artworks of Lorestan. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Gholamy, S., Shapoori, M., Mehdinejad, K. and Pajand, Z. 2014. Effect of beach-seine catching activities on changes of substrate structure in the southern coast of the Caspian Sea (in Rudsar and Chaboksar). Journal of Marine Biology, 6(1):29-38. In Farsi.

Gholi Tabar, R., Jafari, V. and Mazandarani, M. 2020. Effects of dietary thyme (*Thymus vulgaris*) extract on the growth indices and some hematological parameters of common

carp (*Cyprinus carpio*) to salinity stress. Journal of Applied Ichthyological Research, 7(4):79-81. In Farsi.
Gholifar, E., Abbasi, E. and Rezaei, A. 2019. Sustainable aquaculture system: institutional scientific collaboration network in Alborz watershed, Iran. Journal of Agriculture Science and Technology, 21(2):277-293.
Gholipoor, F. 1996. Survey of growth of grass carp in relation to aquatic plant consumption. Abzeeyan, Tehran, 7(1):36-38. In Farsi.
Gholipour Cheshm Gilak, M. 2017. Investigation of mean weight and density of *Hypophthalmichthys molitrix* silver carp in Dousti barrier due to the concentration of compounds containing mercury. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Gholipour Kananim, H., Kian Zaheri, M., Haramabadi, B. and Mehrpak, M. 2013. Determination of acute toxicity (LC50 96h) of glyphosate in (Cyprinidae: *Alburnoides* sp,). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 74 (abstract).
Gholipourkanani, M., Jamali, F., Jafaryan, H. and Gholamalipour Alamdari, E. 2017. Dietary effect of *Lippia citrodora* essential oil on some hematological, biochemical, growth performance and body composition of *Cyprinus carpio* Linnaeus, 1758. Iranian Journal of Aquatic Animal Health, 3(1):1-15.
Gholizade, M., Ghorbani, R., Salman Mahini, A. R., Hajimoradloo, A. M., Rahmani, H., Mollaei, M. and Nemati, M. 2009. Food habits of *Capoeta capoeta gracilis* in Zarrin-gol Stream, Golestan Province. Journal of Agricultural Sciences and Natural Resources, 16(Special Issue 2):70-76. In Farsi.
Gholizadeh, A. K., Khoshkhalq, M. R. and Falahatkar, B. 2020. The effect of different levels of zero-iron nanoparticles on dietary capacity on growth, carcass quality and biochemical characteristics of common carp (*Cyprinus carpio*). Journal of Aquatic Ecology, Hormozgan University, 8(4):51-64. In Farsi
Gholizadeh, M. 2016. Effects of riparian land use on water quality and *Capoeta gracilis* (Keyserling 1891) (*sic*) in the Zarin-Gol stream, Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Gholizadeh, M., Ghorbani, R., Salman Mahini, A. A. R., Haji Moradlou, A. A., Rahmani, H. and Molaei, M. 2009. An investigation on morphology, age and growth of *Capoeta capoeta gracilis* in Zarrin-Gol stream, Golestan Province of Iran. Journal of Agricultural Sciences and Natural Resources, 16(Special Issue 1-A). In Farsi.
Gholizadeh, M. and Harsij, M. 2016. Assessing biotic integrity and effects of land cover and habitat structure on *Capoeta gracilis* (Keyserling, 1891) (*sic*) and macroinvertebrates in Zarin Gol. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Gholizadeh, M., Khosozadeh, F. and Peyvandi, N. 2014. Study on faunistic of fish fauna in Kelarud River (Babol), (Mazandaran province). Journal of Applied Ichthyological Research, 2(1):1-10. In Farsi.
Gholizadeh, M. B. 1963. Paper No. 6. Tidal irrigation in the delta of the Karun and Shatt-al-Arab rivers with complications from increased salinity of water, pp. 187-193. In: Proceedings of the Regional Symposium on Flood Control, Reclamation, Utilization and Development of Deltaic Areas (Held at Bangkok, Thailand, 2 to 9 July 1963), United Nations, New York, Water Resources Series, 25.

Gholizadeh, M. B. and Fatemi, M. R. 1969. A study of a change from tidal irrigation to gravity irrigation on Abadan Island in the delta of the Arvandrud and Karun rivers, pp. 177-194. In: Proceedings of the Second Symposium on the Development of Deltaic Areas (Held at Tokyo, Japan, 4 to 13 July 1969), United Nations, New York, Water Resources Series, 39.

Ghomi, M. R. 2016. Determination of lead, mercury, arsenic and cadmium levels in muscle of common carp (*Cyprinus carpio*) in southern Caspian Sea and Gomishan and Anzali wetlands. Fresenius Environmental Bulletin, 25(2):401-408.

Ghomi, M. R., Faghani Langroudi, H. and Ovissipour, M. 2011. A study on the role of chemical and organic fertilizer on lernaeasis in a rearing cyprinids fish farm in Guilan. Veterinary Journal (Pajouhesh va Sazandegi), 24(4)(89):6-11. In Farsi.

Ghomi, M. R., Hashemi, S. and Makhdomi, C. 2017. The relationship between weight and total length of males and females broodstocks with some reproductive parameters of *Rutilus frisii kutum* in reproduction time in Shirud River. Journal of Animal Biology, 9(2):67-73. In Farsi.

Ghomi, M. R., Hashemi, S. S., Cheraghpur, M., Mohammadi, E., Mousavi, S. H. and Matani, H. A. 2017. The relationship between physico-chemical parameters of Shirud River with the reproductive parameters of the *Rutilus frissi* (*sic*). New Technologies in Aquaculture Development (Journal of Fisheries), 11(3):25-36. In Farsi.

Ghomi, M. R., Heshmatipour, Z., Sohrabnezhad, M. and Zarei, M. 2010. The effect of photoperiod on gut bacterial load in (*Rutilus frisii kutum*) in juvenile stage. Journal of Marine Biology, 1(4):47-58. In Farsi.

Ghomi, M. R., Jadid Dokhani, D. and Hasandoust, M. 2012. Comparison of fatty acids and amino acids profile and proximate composition in rainbow trout (*Oncorynchus mykiss*), common carp (*Cyprinus carpio*) and kutum (*Rutilus frisii kutum*). Journal of Fisheries, 5(4):1-8. In Farsi.

Ghomi, M. R. and Nikoo, M. 2011. Application of nisin and sodium acetate on fatty acid composition of cultured grass carp *Ctenopharyngodon idella* fillets during storage at 4°C. Journal of Animal Physiology and Development (Journal of Biological Sciences), 4(1):99-104. In Farsi.

Ghomi, M. R., Sohrabnejad, M., Nikoo, M. and Jamalzadeh, H. 2014. Combination effect of dietary probiotic and vitamin C on growth performance of kutum *Rutilus frisii kutum*. Aquaculture Europe 2014, Donostia-San Sebastián, Spain, October 14-17, 2014 (abstract).

Ghomi Marzdashti, M. R. and Azari Takami, G. 2004. Effect of species combination on growth and yield of cultured carps. Iranian Journal of Natural Resources, 5(1):145-156. In Farsi.

Ghorbani, M. 2011. Reproductive biology of Mossul bleak (*Alburnus mossulensis*) in Bibi-Sayyedan River of Semirom, in Isfahan Province. M.Sc. Thesis, Isfahan University of Technology, Isfahan.

Ghorbani, R., Abbasi, F., Molaei, M. and Naeimi, A. 2013. Identification and distribution of fish fauna in Kaboodval Stream (Golestan Province, Iran). World Journal of Fish and Marine Sciences, 5(5):467-473.

Ghorbani, R., Abbasi, F., Molaei, M., Naeimi, A., Baghfalaki, M. and Forouhar Vajargah, M. 2015. Identification and distribution of fish fauna in Tilabad stream (Golestan province). Journal of Animal Environment, 7(1):277-286. In Farsi.

Ghorbani, R., Hedayati, A., Hashemi, A. R., Abolhasani, M. H., Haghi Vayeghan, A. and Amini

Charmehini, M. 2018. Population dynamics of *Carasobarbus luteus* in Shadegan International Wetland, Iran. Iranian Journal of Fisheries Sciences, 17(2):357-368.

Ghorbani R., Hosseini, S. A., Hedayati, S. A. A., Hashemi, S. A. R. and Abolhasani, M. H. 2016. Evaluation of effects of physico-chemical factors on chlorophyll-a in Shadegan International Wetland-Khouzestan Province - Iran. Iranian Journal of Fisheries Sciences, 15(1):360-368.

Ghorbani, R., Norouzrajabi, A., Abdi, O. and Nabavi, E. 2019. Effect of Qezel Kosar rainbow trout (*Oncorhynchus mykiss*) farm effluent on some abiotic and biotic characteristics in Daryasar River, Mazandaran Province. Journal of Aquaculture Development, 13(2):139-154. In Farsi.

Ghorbani, R., Yelghi, S. and Aghili, S. M. 2010. Survey and assessment of predation of fish beach seine cooperative companies in Golestan Province in 2005-2006. Journal of Fisheries, 4(3)(15):39-46. In Farsi.

Ghorbani, S., Moghadam, D. P., Salavatian, M. and Rofchaei, R. 2018. Effect of dietary energy levels on the growth and nutrition performance of roach (*Rutilus lacustris*). Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Ghorbani, S., Talebi Haghighi, D., Maghsoodieh Kohan, H., Salavatian, S. M. and Parvaneh Moghadam, D. 2019. The effect of dietary lipid levels on growth of roach Caspian Sea (*Rutilus rutilus caspicus*) fingerling. Journal of Marine Sciences and Technology, 18(1):33-42. In Farsi.

Ghorbani, S. A. 2016. Investigation of nutritional requirements of Caspian Roach (*Rutilus rutilus caspicus nipowitschi* (*sic*)) fingerling. Iranian Fisheries Science Research Institute, Tehran. 58 pp. In Farsi.

Ghorbani Chafi, H. 2000. Identification of different fish species in Koohrang, Bazoft and Zayandeh Rood River in Chahar Mahal-e-Bakhtiary Province. Iranian Scientific Fisheries Journal, 8(4):43-56, 5. In Farsi.

Ghorbani-Ranjbari, Z., Keivany, Y. and Zamani-Faradonbe, M. 2018. Geometric morphometric comparison of *Barilius mesopotamicus* (Berg 1932) populations in Diala and Tigris River Basins. Journal of Fisheries (Iranian Journal of Natural Resources), 70(3):231-242. In Farsi.

Ghorbani Ranjbary, A., Ghorbani Ranjbary, N., Ghorbani Ranjbary, Z., Marhamtizadeh, M. H. and Cheraghi, P. 2013. Determination of lead, mercury and cadmium concentrations in different organs of *Barbus grypus* and *Liza abu* of Karoon River in 2011. Journal of Food Hygiene, 2(4)(8):53-60. In Farsi.

Ghorbani Vaghei, R. and Ahmadi, M. R. 2007. The comparison of diversity and abundance of macrozoobenthos in three farms of Chinese carps in Guilan Province. Pajouhesh va Sazandegi, 19(1)(74):58-66. In Farsi.

Ghorbanizadeh Kharazi, H., Sedeghi, H., Saghafian, B. and Porhemmat, J. 2010. Study on the effect of climate change on snowmelt runoff timing in Karoon basin. Iranian Journal of Watershed Management, Science and Engineering, 3(9):45-50.

Ghorbankhah, M. and Bani, A. 2020. Inherent immunological parameters in kutum, *Rutilus frisii*, larvae obtained from the adult females with orange and green eggs. Journal of Fish Biology, 98(2):572-576.

Ghorbanzadeh, G., Rafiee, G., Eagderi, S., Pourbagher, H. and Efatpanah, I. 2014. Early development and allometric growth patterns in Caspian kutum (*Rutilus frisii kutum*).

Journal of Fisheries Science and Technology, 3(2):35-50. In Farsi.
Ghorbanzadeh Zaferani, S. Gh., Machinchian Moradi, A., Mousavi Nadushan, R., Sari, A. R. and Fatem, S. M. R. 2016. Distribution pattern of heavy metals in the surficial sediment of Gorgan Bay (South Caspian Sea, Iran). Iranian Journal of Fisheries Sciences, 15(3):1144-1166.
Ghorbanzadeh Zafarani, S. G., Karami Rad, N. and Jamili, Sh. 2016. Effect of lead sub-lethal concentration on blood iron content of the common carp, *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 25(1):67-79. In Farsi.
Ghorbanzadeh Zaferani, S. Gh., Mashinchian Moradi, A., Sari, A. R., Keramat Hashemi Ana, S. and Fatemi, S. M. R. 2020. Classification of Gorgan Bay by using ecological indices. Journal of Animal Environment, 12(2):401-410. In Farsi.
Ghoreishvandi, S., Hosseini, S. M. and Rezaie, A. 2021. Study of microbial, biochemical and sensorial changes in gattan (*Luciobarbus xanthopterus*) during ice storage. Journal of Marine Science and Technology, 19(4):13-24. In Farsi.
Ghoroghi, A., Varedi, E. and Ghezel, A. 2013. Hydrology and hydro biology of Babolrood. Iranian Fisheries Science Research Institute, Tehran. 142 pp. In Farsi.
Ghosseiri, Sh., Hedayatifard, M. and Moetamedzadegan, A. 2014. Production of fish cake from big-head carp *Aristichthys nobilis* and evaluation of qualitative changes and microbial count of selected product during freezer storing. Journal of Food Hygiene, 4(1):33-45. In Farsi.
Ghotranpour, M., Pourbagher, H. and Eagderi, S. 2018. Sangan Dam on the utility of *Barbus cyri* in the Shahrud River, Caspian basin. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Ghovati, N., Mohammadi, S. and Mohammadi, V. 2011. Assess changes in hardness and alkalinity on the toxicity of zinc poisoning in common carp (*Cyprinus carpio*). Journal of Wetland Ecobiology, 2(8):21-28. In Farsi.
Gilannejad, N., Dorafshan, S., Heyrati, F. P., Soofiani, N. M., Asadollah, S., Martos-Sitcha, J. A., Prat, F., Yúfera, M. and Martínez-Rodríguez, G. 2016. Vitellogenin expression in wild cyprinid *Petroleuciscus esfahani* as a biomarker of endocrine disruption along the Zayandeh Roud River, Iran. Chemosphere, 144:1342-1350.
Gilles, A., Lecointre, G., Miquelis, A., Loerstcher, M., Chappaz, R. and Brun, G. 2001. Partial combination applied to phylogeny of European cyprinids using the mitochondrial control region. Molecular Phylogenetics and Evolution, 19(1):22-33.
Ginzburg, Ya. I. 1936. K sistematike i biologii shemai *Chalcalburnus chalcoides* (Güldenstädt) iranskogo poberezh’ya Kaspiiskogo Morya [A taxonomic and biological study of the shemaya *Chalcalburnus chalcoides* (Güldenstädt) from the Iranian coast of the Caspian Sea]. Izvestiya Azerbaidzhanskogo Filiala Akademii Nauk SSSR, 1936(1):53-62.
Glantz, M. H. and Zonn, I. S. (Eds.). 1997. Scientific, Environmental, and Political Issues in the Circum-Caspian Region. Kluwer Academic Publishers, Dordrecht/Boston/London. xvi + 312 pp.
Gleick, P. H. (Ed.). 1993. Water in Crisis. A Guide to the World’s Fresh Water Resources. Oxford University Press, New York. xxiv + 473 pp.
Gmelin, S. G. 2007. Travels through northern Persia 1770-1774 by Samuel Gottlieb Gmelin. Translated and Annotated by Willem Floor. Mage Publishers, Washington, D.C. xxvii + 381 pp.
Goblot, H. 1963. Dans l’ancien Iran, les techniques de l’eau et la grande histoire. Annales

Économies, Sociétés, Civilisations, 18(3):499-519.
Goblot, H. 1979. Les qanats. Une technique d'acquisition de l'eau. École des Hautes Études en Sciences Sociales, Centre de Recherches Historiques, Industrie et artisanat, 9, Mouton, Paris. 236 pp., 14 plates.
Gohari, A., Eslamian, S., Mirchi, A., Abedi-Koupaei, J., Bavani, A. M. and Madani, K. 2013. Water transfer as a solution to water shortage: A fix that can backfire. Journal of Hydrology, 491:23-39.
Gohari, A., Bozorgi, A., Madani, K., Elledge, J. and Berndtsson, R. 2014. Adaptation of surface water supply to climate change in central Iran. Journal of Water and Climate Change, 5(3):391-407.
Gökçek, C. K. and Akyurt, I. 2008. Age and growth characteristics of himri barbel (*Barbus luteus* Heckel, 1843) in Orontes River, Turkey. Turkish Journal of Zoology, 32(4):461-467.
Golani, D. 1997. Handbook of the Fishes of Israel. Keter Publishing House, Jerusalem. 269 pp. In Hebrew.
Golbaz Hagh, F. and Wossughi, Gh. 1985. The study of microscopic anatomy of barbels in Acipenser nudiventris, Acipenser stellatus, Silurus glanis, Cyprinus carpio, Capoeta barroisi and Tor grypus fishes. Journal of the Veterinary Faculty of the University of Tehran, 40(2, 3 and 4):27-44. In Farsi.
Golchin Manshadi, A., Kiamarsi, E. and Tarahomi, M. 2019. Identification and survey on frequency of Bashar river's fish, Kohgiluyeh and Boyer-Ahmad Province. Journal of Experimental Animal Biology, 8(1):67-75. In Farsi.
Golchin Manshadi, A. R. 2017. Gill parasites of Parishan lake's native and introduced fish. New Technologies in Aquaculture Development (Journal of Fisheries), 11(2):29-40. In Farsi.
Golchin Manshadi, A. R. 2018. Identification of gill parasites of Parishan Lake's fish from Kazerun. Journal of Utilization and Cultivation of Aquatics, 7(2):63-72. In Farsi.
Golchin Manshadi, A. R. and Khaj, H. 2016. Study of changes of some hematological factors of *Barbus luteus* and its comparison with fishes infected by larval stage of *Contracaecum* sp. Veterinary Clinical Pathology (Veterinary Journal Tabriz), 10(1):29-37. In Farsi.
Golchin Manshadi, A. R., Malahi, S. and Tarahomi, M. 2018. Survey on visceral parasites of Fahlian River' fish, Nurabad Mamasani. Veterinary Clinical Pathology (Veterinary Journal Tabriz), 12(1):21-30. In Farsi.
Golchin Manshadi, A. R., Mashayekhi, A. and Tarahomi, M. 2017. Identification of fish parasites of Shapour River, Kazerun, Fars. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 29(4):82-91. In Farsi.
Golchin Manshadi, A. R., Masoumian, M., Jalali Jafari, B. and Barzegar Dowlatabadi, M. 2012. Protozoan and myozoan infections in some fishes of Parishan Lake. Asian Journal of Animal and Veterinary Advances, 7(9):842-850.
Golchin Manshadi, A. R., Naghmehsanj, H. and Sadeghi Limanjoob, R. 2014. Identification of native and foreign fish fauna of Fars's Parishan Lake. Journal of Animal Biology, 7(1):83-92. In Farsi.
Golchinrad, A., Askari Hosni, M., Naser Alavi, M. Gh. and Atabati, M. 2008. An investigation on the effects of anionic detergents on liver glycogen and glucose in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 17(3):161-164. In Farsi.
Golden, F. 1982. Making rivers run backward. Time, June 14:88.
Goldsmith, E. and Hildyard, N. (Eds.). 1984. The Social and Environmental Effects of Large

Dams. Volume One: Overview, 346 pp., 2 appendices, references; Volume Two: Case Studies, 331 pp.; Volume III: A Review of the Literature (Trussell, D. (Ed.), xiv + 243 pp. Wadebridge Ecological Centre, Camelford, U.K.

Golestani Bakht, T. 2011. Study of effects of shock exposures on subsequent escape-avoidance conditioning learning by goldfish (*Carassius auratus*). Clinical Psychology and Personality (Daneshvar Raftar), 3(4):31-40.

Golestaninasab, M., Malek, M., Jalali, B. and Mobedi, I. 2012. Variation in sex ratio of *Rhabdochona fortunatowi* (Spirurida: Rhabdochonidae) in *Capoeta capoeta gracilis* (Cypriniformes: Cyprinidae), relative to levels of infection, host size and temperature. Journal of Helminthology, 86(1):41-45.

Goleyj, M. 2015. Biometric studies of *Rutilus frissi* (*sic*) *kutum* in the ripeness and sexual rest stagees (*sic*) in Anzali Wetland and Cheshmekileh River (Caspian Sea basin). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 188.

Golgolipour, S., Khodanazary, A. and Ghanemi, K. 2017. Effect of different cooking methods on changes of free fatty acids, thiobarbitoric acid, heavy metal (Ni, Cr, Co, Cd, Pb) and sensory properties of grass carp (*Ctenopharyngodon idella*). Iranian Food and Science Technology Research Journal, 12(5):630-638.

Golgolipour, S., Khodanazary, A. and Ghanemi, K. 2019. Effect of different cooking methods on minerals, vitamins and nutritional quality indices of grass carp (*Ctenopharyngodon idella*). Iranian Journal of Fisheries Sciences, 18(1):110-123.

Goli, S., Jafari, V. and Ghorbani, R. 2013. Effect of different concentrations of classic taste substances on parameters of feeding behavior of *Rutilus frisii kutum*. Global Veterinaria, 10(2):134-139.

Goli, S., Jafari, V., Ghorbani, R. and Kasumyan, A. 2015. Taste preference and taste thresholds to classical taste substances in the carnivorous fish, kutum *Rutilus frisii kutum* (Teleostei: Cyprinidae). Physiology and Behavior, 140:111-117.

Goli, S., Jafari, V., Ghorbani, R. and Nuri, G. 2013. The study of feeding behaviour of *Rutilus frisii kutum* to stimulant taste substance. Journal of Utilization and Cultivation of Aquatics, 2(1):111-125. In Farsi.

Golmohammadi, A. and Shariati, S. 2017. Study of trophic status of Amirkelaye wetland in Iran using TSI index. Journal of Wetland Ecobiology, 8(4):63-72. In Farsi.

Golmohammadi, S., Moattar, F., Rahmani, H., Ouraji, H. and Moghaddas, D. 2013. Comparison of heavy metal accumulation in muscle and liver tissues on the chub *Squalius cephalus* in Tajan River, Mazandaran. Journal of Fisheries, 7(2)(26):1-6. In Farsi.

Golpoor, A., Hoseini, S. A., Hedayati, S. A., Jafar Nodeh, A. and Khalaji, M. 2020. Effect of algae *Padina australis* Hauck extract on growth indices of common carp (*Cyprinus carpio*). Journal of Animal Environment, 12(2):203-208. In Farsi.

Golpour, A., Akhoundian, M., Khara, H., Rahbar, M. and Dadras, H. 2013. Changes of sperm quality parameters in Caspian roach (*Rutilus rutilus caspicus*) during spawning migration. Czech Journal of Animal Science, 58(3):117-124.

Golpour, A., Esfandyari, M. and Dadras, H. 2016. The influence of ovarian fluid on the sperm physiology of *Rutilus kutum*. Iranian Journal of Fisheries Sciences, 14(4):818-825.

Golpour, A., Hosseini, S. A., Hedayati, S. A., Jafar Nodeh, A. and Khalaji, M. 2019. Effect of *Padina australis* Hauck algae feeding on the mucus resistance indices of *Cyprinus carpio* in exposure to silver nanoparticles. Journal of Aquaculture Sciences, 7(1):96-102. In

Farsi.
Golpour, A. and Imanpoor, M. R. 2010. Relationships between compositions of seminal plasma and blood plasma parameters in Caspian roach (*Rutilus rutilus caspicus*) during the reproductive season. Research Journal of Fisheries and Hydrobiology, 5(2):105-110.
Golpour, A., Imanpoor, M. R. and Hoseini, S. A. 2014. The assessment effect of spawning migration time on ionic ratios of seminal plasma in (*Rutilus rutilus caspicus*). Journal of Animal Researches (Iranian Journal of Biology), 27(2):185-193. In Farsi.
Golpour, A., Imanpoor, M. R., Hosseini, S. A. and Sharbati, S. 2011. Spermatological and biochemical parameters of semen in roach (*Rutilus rutilus caspicus*) during spawning. Journal of Fisheries (Iranian Journal of Natural Resources), 64(1):75-83. In Farsi.
Golshahi, K., Amani, K., Moradnezhad, H. R. and Aramli, M. S. 2009. Photo's color effects and photoperiods on growth and survival rate in *Rutilus rutilus caspicus* larvae of Caspian Sea. Journal of Fisheries, 3(3):71-76. In Farsi.
Golshahi, K. and Moradnezhad, H. R. 2009. Investigation of migration and propagation of *Rutilus frisii kutum* in Gaharbaran River (Mazandaran Province). Journal of Fisheries, 2(4):75-79. In Farsi.
Golshan, M., Hatef, A., Habibi, H. R. and Alavi, S. M. H. 2020. A rapid approach to assess estrogenic transcriptional activity of bisphenol A in the liver of goldfish. Iranian Journal of Fisheries Sciences, 19(6):2877-2892.
Golshan, N., Mirdar Harijani, J., Gharaei, A. and Jamshidian, A. 2018. The effect of anesthetic lavender (*Lavandula officinalis*) essential oil on histopathological and blood biochemical enzymes of silver carp (*Hypophthalmichthys molitrix*). Journal of Veterinary Research, 73(1):9-15. In Farsi.
Golshani, R. 2016. Impact numerical estimation of organophosphate pesticides pollution in economic fishes of south Caspian Sea estuaries using AchE bioassay (biomarker). Ph.D. Thesis, Islamic Azad University, Tehran. 226 pp. In Farsi.
Golshani, R., Mashinchian Moradi, A., Mosavi Nodoshan, R., Fatemi, S. and Ghavam Mostafavi, P. 2020. Organophosphorus pesticides (diazinon, malathion and azinphos methyl) accumulation in three fish species, in south coasts of the Caspian Sea. Iranian Journal of Fisheries Sciences, 19(6):3050-3062.
Golub, R. 1992. The Caspian/Khazar Sea. Environmental Policy Review, 6:1-10.
Golubev, G. N. 1996. Caspian and Aral Seas: two different paths of environmental degradation. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 26(1):159-166.
González-Solís, D., Moravec, F. and Coad, B. W. 1997. Some nematode parasites of fishes from southwestern Iran. Zoology in the Middle East, 15(1):113-119.
Goren, M. 1974. The freshwater fishes of Israel. Israel Journal of Zoology, 23(2):67-118.
Goren, M., Fishelson, L. and Trewavas, E. 1973. The cyprinid fishes of *Acanthobrama* Heckel and related genera. Bulletin of the British Museum (Natural History) Zoology, 24(6):293-315.
Goren, M. and Ortal, R. 1999. Biogeography, diversity and conservation of the inland water fish communities in Israel. Biological Conservation, 89(1):1-9.
Gorgin, S. and Sudagar, M. 2008. Distribution of *Macrobrachium nipponense* (De Haan, 1849) in Iran (Decapoda, Palaemonidae). Crustaceana, 81(8):943-948.
Gorgizade, A., Bagherian Marzouni, M., Jafarzade Haghighifard, N., Rafiei, M. and Esmaeili, M. 2014. Water quality evaluation of Bamdezh Wetland using combination of NSFWQI

and geographic information system. International Journal of Advanced Biological and Biomedical Research, 2(5):1454-1467.

Gorji-Bandpy, M. and Hooman, K. 2004. Caspian Sea level fluctuations. Caspian Journal of Environmental Sciences, 2(1):1-8.

Gorjian Arabi, M. H., Hosseini, S. A., Roohi, M., Patimar, R., Vatandust, S. and Alijanpour, E. 2012. Age structure and growth rate of *Squalius cephalus* (Linnaeus, 1758) in Tuji tributary from Talar River, Mazandaran Province. Iranian Scientific Fisheries Journal, 21(3):107-118. In Farsi.

Gorjian Arabi, M. H., Roohi, M., Kazemian, M., Vatandust, S. and Janbazi, A. 2011. Survey on morphological diversity of European chub (*Squalius cephalus*) in Touji head branch of Talar River in Mazandaran Province. Journal of Marine Science and Technology Research, 6(1):26-39. In Farsi.

Gorjian Arabi, M. H., Sedaghat, S., Hoseini, S. A. and Fakhri, A. 2012. Age and growth of kutum, *Rutilus frisii kutum* (Kamenskii 1901) in Tajan River (southern Caspian Sea to Iran). Global Veterinaria, 9(2):211-214.

Gorjian Arabi, M. H., Shapoori, M., Hosseinzadeh, M. A., Erfanifar, E., Abedi, K. and Erfanifar, E. 2013. Effectiveness of macroinvertebrate-based biotic indexes (*sic*) in assessing lake water quality in Gahar, Iran. World Journal of Zoology, 8(3):285-191.

Gorjian Arabi, M. H., Vatandust, S., Janbazi, A., Motakef, S., Sedaghat, S. and Gorjian, M. K. 2010. Study on morphological diversity of *Barbus lacerta* (Heckel, 1843) in Keseliyan River, Mazandaran Province. Journal of Marine Biology, 2(3):53-63. In Farsi.

Gorjian Arabi, M. H., Vatandust, S., Kazemian, M. and Keshavarz, M. 2009. Survey on some population structure of Kura barbel (*Barbus lacerta*) in Kesilian River in Mazandaran Province. Journal of Marine Science and Technology Research, 4(3):67-78. In Farsi.

Gorjian Arabi, M. H., Vatandust, S., Razeghi Mansour, M., Maleki, H., Mousavi, S. H. and Panahi, H. 2010. Investigation of morphometric and meristic characteristics of *Rutilus frisii kutum* (Nordmann, 1840) populations in both Shazdehrood and Shirood rivers (southern basin of Caspian Sea). Journal of Aquatic Sciences, 1(2):63-79. In Farsi.

Gorjipoor, A., Asadi, M. and Hasanpoor, B. 2007. Limnological investigation of Zohreh River. Pajouhesh va Sazandegi, 19(1)(74):105-110. In Farsi.

Gorshkova, G., Gorshkov, S. and Golani, D. 2002. Karyotypes of *Barbus canis* and *Capoeta damascina* (Pisces, Cyprinidae) from the Middle East. Italian Journal of Zoology, 69(3):191-194.

Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., Caiola, N., Cakic, P., Djikanovic, V., Esmaeili, H. R., Falka, I., Golicher, D., Harka, A., Jeney, G., Kováč, V., Musil, J., Nocita, A., Povz, M., Poulet, N., Virbickas, T., Wolter, C., Tarkan, A. S., Tricario, E., Trichkova, T., Verreycken, H., Witkowski, A., Zhang, C., Zweimueller, I. and Britton, J. R. 2010. Pan-continental invasion of *Pseudorasbora parva*: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4):315-340.

Green, A. 1986. A note on the Assyrian “goat-fish”, “fish-man” and “fish-woman”. Iraq, 48:25-30, pl. V-X.

Greenfield, D. W. 1973. An evaluation of the advisability of the release of the grass carp, *Ctenopharyngodon idella*, into the natural waters of the United States. Transactions of the Illinois State Academy of Science, 66(1-2):47-53.

Gribbin, J. 1979. Climatic impact of Soviet river diversions. New Scientist, 84(1184):762-765.

Griffiths, F., RaLonde, R. and Walczak, P. 1972. Review of Fisheries and Aquatic Biology

Projects, 1971-1972. Fisheries Research Institute, Bandar Pahlavi, Iran. MS, 16 pp. + 6 pp. on reports written by RaLonde and Walczak, 1969-1972.
Griffiths, H. I., Schwalb, A. and Stevens, L. R. 2001. Environmental change in southwestern Iran: the Holocene ostracod fauna of Lake Mirabad. Holocene, 11(6):757-764.
Grigorovich, I. A., Therriault, T. W. and MacIsaac, H. J. 2003. History of aquatic invertebrate invasions in the Caspian Sea. Biological Invasions, 5(1-2):103-115.
Groombridge, B. (Ed.). 1992. Fishes, pp. 116-135. In: Global Biodiversity. Status of the Earth's Living Resources. A report compiled by the World Conservation Monitoring Centre. Chapman & Hall, London. xx + 585 pp.
Gruvel, A. 1931. Les États de Syrie. Richesse marines et fluviales. Exploitation actuelle - Avenir. Bibliothèque de la Faune des Colonies Françaises, Paris. 453 pp., map.
Güçlü, S. S., Küçük, F., Turan, D., Çiftçi, Y. and Mutlu, A. G. 2018. A new *Chondrostoma* species from the Büyük Menderes River Basin, Turkey (Teleostei: Cyprinidae). Zoology in the Middle East, 64(3):315-321.
Gudger, E. W. 1924. The sources of the material for Hamilton-Buchanan's Fishes of the Ganges, the fate of his collections, drawings and notes, and the use made of his data. Journal and Proceedings of the Asiatic Society of Bengal, 19(4):121-136.
Gudger, E. W. 1945. The giant freshwater fishes of Asia. Journal of the Bombay Natural History Society, 45(3):374-390.
Gudkov, P. K. 1985. Biology of goldfish, Carassius auratus gibelio, from the Volga Delta. Journal of Ichthyology, 25(4):157-160.
Gul, A., Yilmaz, M. and Solak, K. 1996. Growth characteristics of *Capoeta trutta* (Heckel, 1843) living in Tohma stream of Firat River. Turkish Journal of Zoology, 20(Supplement):177-185.
Gül, S., Çolak, A. and Sezgin, I. 2000. Gümüş Balığı'nda (*Chalcalburnus mossulensis* Heckel, 1843) Karyotip Analizi [Karyotype analysis in *Chalcalburnus mossulensis* (Heckel, 1843)]. Turkish Journal of Biology, 24(3):657-662.
Gul, S., Nur, G. and Baysa, F. 2006. Karyotype analysis of *Alburnus filippii*. Indian Veterinary Journal, 83(1):102-103.
Güldenstädt, J. A. von 1772. *Salmo leucichthys* et *Cyprinus chalcoïdes* descripti. Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae, 16(1771):531-547. In Latin.
Güldenstädt, J. A. von 1773. *Cyprinus capoeta* et *Cyprinus mursa*. Novi Commentarii Academiae Scientiarum Imperialis Petropolitanae, 17(1772):507-521, pls. VIII-IX. In Latin.
Güldenstädt, J. A. von 1781. *Cyprinus barbus* et *Cyprinus capito* descripti. Acta Academiae Scientiarum Imperialis Petropolitanae, 2(1778):239-260, pls. VIII-X. In Latin.
Gümüş, A., Yılmaz, M. and Polat, N. 2002. Relative importance of food items in feeding of *Chondrostoma regium* Heckel, 1843, and its relation with the time of annulus formation. Turkish Journal of Zoology, 26(3):271-278.
Günther, A. 1859-1870. Catalogue of the fishes in the British Museum. London. 8 volumes.
Günther, A. 1869. The fishes of the Holy Land. The Student and Intellectual Observer of Science, Literature and Art, 3:409-417.
Günther, A. 1874. A contribution to the fauna of the River Tigris. The Annals and Magazine of Natural History, 4(14):36-38, pl. VIII-IX.
Günther, A. 1889. Fishes, pp. 106-109, pl. XII. In: Aitchison, J. E. T. The Zoology of the Afghan

Delimitation Commission. Transactions of the Linnaean Society of London, Second Series, 5.

Günther, A. 1896. Description of two new species of fishes (*Mastacembelus* and *Barbus*). The Annals and Magazine of Natural History, 6(17):397.

Günther, A. 1899. Fishes, pp. 381-391, pl. 23-24. In: Günther, R. T. Contributions to the natural history of Lake Urmi, N. W. Persia, and its neighbourhood. Journal of Zoology of the Linnaean Society, 27:345-453, pl. 21-30.

Günther, R. T. 1899. Contributions to the natural history of Lake Urmi, N. W. Persia, and its neighbourhood. Journal of Zoology of the Linnaean Society, 27:345-453, pl. 21-30.

Gürbüz, Ö. A. 2020. Endemic fishes in transboundary river basins in Turkey. Eurasian Journal of Biological and Chemical Sciences, 3(2):138-142.

Gussev, A. V., Jalali, B. and Molnár, K. 1993a. Six new species of the genus *Dactylogyrus* (Monogenea: Dactylogyridae) from Iranian freshwater fishes. Zoosystematica Rossica, 2(1):29-35.

Gussev, A. V., Jalali, B. and Molnár, K. 1993b. New and known species of *Dactylogyrus* Diesing, 1850 (Monogenea, Dactylogyridae) from Iranian freshwater cyprinid fishes. Systematic Parasitology, 25(3):221-228.

H

Habbeb, F. Sh. 2014. Biometric characteristic of the common goldfish *Carassius auratus auratus* (Linnaeus, 1758) in Basra freshwater systems. Mesopotamian Journal of Marine Science, 29(2):155-161.

Habibi, A., Mosavi-Sabet, S. H., Bagherpur, O. and Heydari, A. 2014. Examination of feeding biology of *Hemiculter leucisculus* in the Sefidrood River, southwestern Caspian Sea basin, northern Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Habibnejaad, H. 1993. No more gill nets in the Caspian Sea. Abzeeyan, Tehran, 4(4):38-43, II. In Farsi.

Hadifar, M., Haghighi Karsidani, S. and Ghasemi, M. 2017. Primary culture of epithelial cells from fin tissue of *Rutilus kutum*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Hadifar, M., Haghighi Karsidani, S. and Ghasemi, M. 2019. The primary cell culture from caudal fin tissue of Caspian kutum (*Rutilus frisii kutum*). Iranian Scientific Fisheries Journal, 28(2):95-104. In Farsi.

Hadgmohammadi, M. R. and Ghaziaskar, H. S. 1989. Quantitative and qualitative determination of heavy and toxic elements in the fishes grown in treated wastewater and their comparison with other fishes. Iranian Journal of Chemistry and Chemical Engineering, 8(1):21-31.

Hadipour, E., Karami, M., Abdoli, A., Borhan, R. and Goljani, R. 2011. A study on Eurasian otter (*Lutra lutra*) in Amirkelayeh Wildlife Refuge and International Wetland in Guilan Province, northern Iran. IUCN Otter Specialist Group Bulletin, 28(2):84-98.

Hafezamini, P. and Oryan, Sh. 2002. The effects of NaCl on hematocrit and hemoglobin of *Cyprinus carpio* blood. Iranian Scientific Fisheries Journal, 11(3):13-22. In Farsi.

Hafezamini, P., Oryan, Sh. and Parivar, K. 2003. Effects of NaCl on blood glucose and cortisol in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 12(3):35-42. In

Farsi.
Haghdoust, S., Khara, H., Alahyari, M. S. and Noorhosseini, S. A. 2015. Investigation of socio-economic effects of rice cultivation in Guilan province. Journal of Aquaculture Development, 9(4):11-20. In Farsi.
Haghi Vayghan, A., Poorbagher, H., Taheri Shahraiyni, H., Fazli, H. and Nasrollahzadeh Saravari, H. 2013. Suitability indices and habitat suitability index model of Caspian kutum (*Rutilus frisii kutum*) in the southern Caspian Sea. Aquatic Ecology, 47(4):441-451.
Haghi Vayghan, A., Zarkami, R., Sadeghi, R. and Fazli, H. 2016. Modeling habitat preferences of Caspian kutum, *Rutilus frisii kutum* (Kamensky, 1901) (Actinopterygii, Cypriniformes) in the Caspian Sea. Hydrobiologia, 766(1):103-119.
Haghiabi, A. M. and Mastorakis, N. E. 2009. Water resources management in Karkheh Basin-Iran. Proceedings of the 3rd International Conference on Energy and Development - Environment - Biomedicine, EDEB'09, Athens, pp. 114-121.
Haghighat, F., Kim, Y., Sourinejad, I., Yu, I. J. and Johari, S. A. 2020. Titanium dioxide nanoparticles affect the toxicity of silver nanoparticles in common carp (*Cyprinus carpio*). Chemosphere, 262:127805.
Haghighi, D. T., Saad, C. R., Hosainzadeh Sahafi, H. and Mansouri, D. 2009. The effect of dietary lipid level on the growth of kutum fry (*Rutilus frisii kutum*). Iranian Journal of Fisheries Sciences, 8(1):13-24.
Haghighi, E., Sattari, M., Dorafshan, S. and Keivany, Y. 2014. Genetic structure of spirlin (*Alburnoides eichwaldii*) in Karganroud and Chalous rivers. Journal of Taxonomy and Biosystematics, 6(19):1-14, 1. In Farsi.
Haghighi, E., Sattari, M., Dorafshan, S., Keivany, Y., Khoshkholgh, M. R. and Mousavi-Sabet, H. 2013. Morphological comparison between two populations of *Alburnoides eichwaldii* from Karganroud and Chalus rivers, using truss network system. Journal of Applied Ichthyological Research, 1(1):41-52. In Farsi.
Haghighi, F. P. 2006a. Investigation of by-catch of sturgeon fishery in the Caspian Sea. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).
Haghighi, F. P. 2006b. Stock discrimination of *Rutilus rutilus* by using otoliths. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).
Haghighi, S. and Arabi, H. 2010. Water exploitation of Karoon River for fish culturing through monitoring and simulation systems. Iranian Journal of Fisheries Sciences, 9(2):209-218.
Haghighi-Khiabanian Asl, A., Azizzadeh, M., Bandehpour, M., Sharifnia, Z. and Kazemi, B. 2008. The first report of SVC from Indian carp species by PCR and histopathologic methods in Iran. Pakistan Journal of Biological Sciences, 11(24):2675-2678.
Haghighy, E., Sattari, M., Dorafshan, S. and Keivany, Y. 2015. Intra-population variations in the morphology of spirlin, *Alburnoides eichwaldii* (Cypriniformes: Cyprinidae) in Kargan-Rud and Lamir rivers in Guilan province, northern Iran. Journal of Experimental Animal Biology, 3(4):37-46. In Farsi.
Haghighy, E., Satari, M., Dorafshan, S., Keivany, Y. and Khoshkholgh, M. R. 2013. Application geometric morphometrics approach for morphometric characters in fish: morphological diversity of spirlin, (Cyprinidae: *Alburnoides eichwaldii*) in the South-western Caspian Sea basin. The First Iranian Conference of Ichthyology, Isfahan University of

Technology, 15-16 May 2013, p. 37 (abstract).
Haghighy, E., Sattari, M., Dorafshan, S., Keivany, Y., Khoshkholgh, M. R. and Mousavi, S. H. 2013. A comparison of the morphological characteristics of spirlin, (Cyprinidae: *Alburnoides eichwaldii*) in Karganrud and Chalus rivers using Truss Network System. Journal of Applied Ichthyological Research, 1(1):41-52, 4. In Farsi.
Haghipoor, M., Sudagar, M., Mazandarani, M. and Hoseinifar, S. H. 2015. The effects of prebiotic isomaltooligosaccharide on some growth factors, survival and resistance to salinity stress of common carp (*Cyprinus carpio*) fry. Journal of Animal Environment, 7(3):235-240. In Farsi.
Haghjou Jahromi, M., Razmara, P. and Faridi, M. 2013. Effect of *Artemia* enriched with vitamin C on growth and survival of *kutum* (Cyprinidae: *Rutilus kutum*) larvae. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 35 (abstract).
Hagh-Panah, V. 1992. General values of the Anzali Bay. Abzeeyan, Tehran, 2:16-21. In Farsi.
Haghpanah, A. and Iri, Y. 2017. Feasibility study on common carp (*Cyprinus carpio* Linnaeus 1758) culture in fresh water earthen ponds in Golestan Province. Journal of Utilization and Cultivation of Aquatics, 6(3):43-49. In Farsi.
Haghparast, M. M., Alishahi, M., Ghorbanpour, M. and Shahriari, A. 2017. Effect of use biofloc technology on water and carp fish intestine bacterial total count in intensive system. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 713-717. In Farsi.
Haghparast, M. M., Alishahi, M., Ghorbanpour, M. and Shahriari, A. 2020. Evaluation of hemato-immunological parameters and stress indicators of common carp (*Cyprinus carpio*) in different C/N ratio of biofloc system. Aquaculture International, 28:2191–2206.
Haghparast, P., Falahatkar, B., Khoshkholgh, M. J., Meknatkhah, B., Efatpanah, I. and Nasrolazadeh, A. 2014. Effects of different dietary protein and lipid levels on growth and feed utilization in a hybrid of *Aspius aspius* ♀ x *Rutilus frisii* ♂. Journal of Aquaculture Development, 8(2):21-34. In Farsi.
Haghparast, P., Falahatkar, B., Meknatkhah, B. and Khoshkholgh, M. 2020. Growth and hematological changes of aspikutum, a hybrid of *Leuciscus aspius* female (Linnaeus, 1758) x *Rutilus frisii* male (Kamensky, 1901), fed rations with various protein to lipid ratio. Iranian Journal of Fisheries Sciences, 19(5):2199-2213.
Haghparast, S., Khaleghi, S. R., Tajari, M., Porsoofi, T. and Shahroodi, M. 2014. Quantitative and qualitative survey on phytoplankton during rearing months in earthen ponds of warm water fish at Sijaval Cultivation Center. Journal of Fisheries, 8(2):39-52. In Farsi.
Hajesmaeil, N. 1998. Microanatomy and histopathology of helminth parasites of fishes and their importance on public health in Khouzestan Province. M.Sc. Thesis, University of Tehran. 131 pp.
Haji Hassani, N., Hasani, A. R., Farahnak Ghazani, M. and Kasebi, N. 2004. Heavy metals concentrations in the largest watershed basin of east Urumieh Lake, Iran. The Joint Agriculture and Natural Resources Symposium, Tabriz-Ganja, May 14-16, 2004. 5 pp.
Hajiaghaei Ghaazi Mahalleh, F. and Imanpour Namin, J. 2021a. An overview of the fish of Anzali Wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 8 pp. In Farsi.

Hajiaghaei Ghaazi Mahalleh, F. and Imanpour Namin, J. 2021b. Investigating the threatening factors of the Anzali wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.

Hajiahmadian, M., Rabbaniha, M., Ghafari Farsani, H., Gerami, M. H. and Shahbazi Naserabad, S. 2018. Age, growth and spawning season of *Luciobarbus esocinus* Heckel, 1843 in Gamasiab River, Iran. Iranian Journal of Fisheries Sciences, 17(1):194-207.

Hajimirrahimi, S. D. and Dadgar, Sh. 2016. Study of barriers and strategies for development of ornamental fish industry in Iran: "case study of Markazi Province". Iranian Scientific Fisheries Journal, 25(3):133-148. In Farsi.

Hajimohamadi, R. 2002. Presentation of improvement methods for fishery management in order to improve product, quality, distribution and aquatics' consumption in the largest cities of Iran. M.Sc. Thesis, Amirkabir University of Technology, Tehran. 73 pp. In Farsi.

Hajipour, N., Seif Reihnai, M. R. and Esmaeilnejad, B. 2019. A survey on the diet, feeding indices and incidence percentage of ichthyophthirosis in spirlin fish (*Alburnoides bipunctatus*) in Kaleybar Chay, Kaleybar, East Azerbaijan, Iran. Iranian Scientific Fisheries Journal, 28(1):201-204. In Farsi.

Hajirad Kochak, E., Patimar, R. and Bahalkeh, A. 2016a. Some reproductive characteristics of *Carassius gibelio* (Bloch, 1782) in Voshmgir dam, Golestan Province, northern Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Hajirad Kochak, E., Patimar, R. and Bahalkeh, A. 2016b. Investigating reproductive characteristics of *Carassius gibelio* (Bloch, 1782) in Golestan dam, Golestan Province, northern Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Hajirad Kochak, E., Patimar, R., Harsij, M. and Ghorbani, R. 2016. Some growth parameters and conditional index of *Carassius gibelio* in Alakoli reservoir, Golestan Province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Hajiradkochak, E., Patimar, R. and Bahalkeh, A. 2016. Comparative study on reproductive characteristics of *Carassius gibelio* (Bloch, 1782) in Boostan dam lake & Alakoli reservoir. Journal of Experimental Animal Biology, 5(2):67-76. In Farsi.

Hajiradkouchak, E., Patimar, R., Harsij, M. and Ghorbani, R. 2019. Age determination, growth indices and reproduction biology of Prussian carp, *Carassius gibelio* (Bloch, 1782) from four reservoirs in Golestan Province, Southeast Caspian Sea. Caspian Journal of Environmental Sciences, 17(4):337-351.

Hajiradkouchak, E., Patimar, R., Harsij, M. and Ghorbani, R. 2020. Study the growth characteristics of (*Carassius gibelio* Bloch, 1782) in the Boostan Dam Lake and Alakoli Reservoir in Golestan Province. Journal of Wetland Ecobiology, 11(4):65-80. In Farsi.

Hajirezaee, S., Mohammadi, G. and Shahbazi Naserabad, S. 2020. The protective effects of vitamin C on common carp (*Cyprinus carpio*) exposed to titanium nanoparticles (TiO_2-NPs). Aquaculture, 518:734734.

Hajirostamloo, M. 2009. A report on occurrence and parasite-host of *Ligula intestinalis* in Sattarkhan Lake (East Azerbaijan-Iran). International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering, 3(9):458-461.

Hakimirad, H. and Esmaeili, H. R. 2015. Ichthyodiversity in qanats of Kerman Province in Iran.

The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 241.

Halajian, A., Tavakol, S., Mortazavi, P., Shokoofeh, S. and Luus-Powell, W. 2011. *Clinostomum complanatum* in birds, a potential pathogen for fishes, Iran. VIII International Symposium of Fish Parasites, 26-30 September 2011, Viña del Mar, Chile (abstract).

Halas, D., Lovejoy, N. and Mandrak, N. E. 2018. Undetected goldfish diversity (*Carassius* spp.) in North America. Aquatic Invasions, 13(2):211-219.

Halimi, M., Golpour, A., Dadras, H., Mohamadi, M. and Chamanara, V. 2014. Quantitative characteristics and chemical composition in Caspian roach (*Rutilus rutilus caspicus*) sperm. Iranian Journal of Fisheries Sciences, 13(1):81-90.

Halimi, M., Hosseinzadeh Colagar, A. and Youssefi, M. R. 2013. Immune response in spirlins (*Alburnoides bipunctatus*, Bloch 1782) infested by *Ligula intestinalis* parasites. Veterinaria Italiana, 49(2):243-246.

Hallajian, A., Yousefi Joordehi, A., Kazemi, R. and Shakoori, M. 2013. Acute effects of $Zn(NO_3)_2$ on the tissue in gill of farmed silver carp (*Hypophthalmichthys molitrix*). Journal of Fisheries, 7(1)(25):73-80. In Farsi.

Hallajian, A., Yousefi Jourdehi, A., Kazemi, R., Abdali, S. and Shakuri, M. 2014. Effects of $Zn(NO_3)_2$ on liver tissue of silver carp, (*Hypophthalmichthys molitrix*). Journal of Aquatic Animals and Fisheries, 5(18):13-20. In Farsi.

Halstead, B. W. 1967-1970. Poisonous and Venomous Marine Animals of the World. Volume Two - Vertebrates. xxxi + 1070 pp., Volume Three - Vertebrates continued. xxv + 1006 pp. United States Government Printing Office, Washington, D.C.

Halstead, B. W. 1978. Poisonous and Venomous Marine Animals of the World (Revised Edition). The Darwin Press, Princeton, New Jersey. xlvi + 1043 pp., 283 pages of plates.

Hamblin, D. J. 1987. Has the Garden of Eden been located at last? Smithsonian, 18(2):127-135.

Hamid, I. W., Agopian, T. and Tigranian, E. A. 1977. Ryby vnutrennych vod Iraka [Inland water fishes of Iraq]. Baghdad. 89 pp.

Hamidan, N. A., Geiger, M. F. and Freyhof, J. 2014. *Garra jordanica*, a new species from the Dead Sea basin with remarks on the relationship of *G. ghorensis*, *G. tibanica* and *G. rufa* (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 25(3):223-236.

Hamidi, Z. and Sadegh, P. Z. 2008. Identification of gol-cheragh and siyah-mahi fish: two species of qanat fish in Iran. Proceedings of the First Regional Conference on Aquatic Ecosystems in Central Iran. Islamic Azad University, Bushehr (abstract).

Hamidinejad, M., Hoseinzadeh Sahafi, H., Dehghan Madiseh, S. and Velayatzadeh, M. 2014. The study of seasonal changes in steroid hormones, progesterone in farmed broodstock of *Labeo rohita* with water quality parameters from Khuzestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 8(3):75-83. In Farsi.

Hamidinezhad, M., Hosseinzadeh Sahafi, H. and Velayatzadeh, M. 2016. Bio technique of artificial breeding and culture of *Barbus sharpeyi* larvae. Breeding and Aquaculture Sciences Quarterly, 4(8):37-46. In Farsi.

Hamilton, A. M. 1937. Road through Kurdistan. The Narrative of an Engineer in Iraq. Faber & Faber Ltd., London. 331 pp., 2 maps.

Hamilton, F. 1822. An account of the fishes found in the river Ganges and its branches. Edinburgh and London. vii + 405 pp., pls. 1-39.

Hanaee Kashani, Z., Imanpoor, M. R., Shabani, A. and Gorgin, S. 2012. The effect of vitamin E

and highly unsaturated fatty acid on growth and some biochemical blood parameters of gold fish (*Carassius auratus gibelio*). Journal of Utilization and Cultivation of Aquatics, 1(1):15-25. In Farsi.

Hanaee Kashani, Z., Imanpoor, M. R., Zadmajid, V. and Mazandarani, M. 2017. Investigation of toxicity and effect of diazinon on biochemical blood factors on gold fish (*Carassius auratus*). Aquatic Physiology and Biotechnology, 5(1):59-68. In Farsi.

Hanayi Kashani, Z., Imanpour, M. R., Zadmajid, V. and Mazandarani, M. 2019. Effects of lethal and sub-lethal concentrations of malathion in gold fish (*Carassius auratus*): haematology, liver histology and liver enzymes. Journal of Applied Ichthyological Research, 6(3):51-62. In Farsi.

Hanel, L., Oliva, O. and Ali, A. M. 1992. Note on the morphometry of *Varicorhinus trutta* (Pisces, Cypriniformes) from Iraq. Acta Societatis Zoologicae Bohemoslovacae, 56(2):115-119, photos 1-2.

Hanel, L., Oliva, O. and Atallah, M. A. 1993. Morphometric note on *Barbus sharpeyi* (Pisces: Cypriniformes: Cyprinidae) from Iraq. Acta Societatis Zoologicae Bohemicae, 57(2):101-103.

Hänfling, B. and Brandl, R. 2000. Phylogenetics of European cyprinids: insights from allozymes. Journal of Fish Biology, 57(2):265-276.

Hänfling, B., Dümpelmann, C., Bogutskaya, N. G., Brandl, R. and Brändle, M. 2009. Shallow phylogeographic structuring of *Vimba vimba* across Europe suggest two distinct refugia during the last glaciation. Journal of Fish Biology 75(9):2269-2286.

Hanko, B. 1924. Fische aus Kleinasien. Annales Musei nationalis Hungarici, 21:137-158, Taf. iii.

Hansman, J. F. 1978. The Mesopotamian delta in the First Millennium, BC. Geographical Journal, 144(1):49-61.

Hantoush, A. A., Al-Saad, H. T. and Abdul-Hussain, E. A. 1999. Seasonal variations of some biochemical aspects of the muscles of some freshwater and marine fishes from Shatt Al-Arab River and northwest Arabian Gulf. Marina Mesopotamica, 14(2):427-453. In Arabic.

Hardouin, E. A., Andreou, D., Zhao, Y., Chevret, P., Fletcher, D. H., Britton, J. R. and Gozlan, R. E. 2018. Reconciling the biogeography of an invader through recent and historic genetic patterns: the case of topmouth gudgeon *Pseudorasbora parva*. Biological Invasions, 20(8):2157-2171.

Hariri, D. 1966. A study of inter-relationship between surface water and ground water in the Karaj River basin, pp. 227-241. In: Symposium on Hydrology and Water Resources Development held in Ankara, Turkey February 7 to 12, 1966, Central Treaty Organization, Ankara. 484 pp.

Harlioğlu, A. G. and Gölbaşi, S. 2013. Changes in fatty acid composition, cholesterol and fat-soluble vitamins during development of eggs and larvae in shabbout (*Barbus grypus*, Heckel, 1843). Journal of Applied Ichthyology, 29(6):1357-1360.

Harlioglu, M. M. and Farhadi, A. 2017. Iranian fisheries status: An update (2004-2014). Fisheries and Aquaculture Journal, 8(1):192.

Harrington, F. A. 1976. Iran: Wildlife research as a basis for management. In: Proceedings of an International Meeting on ecological guidelines for the use of natural resources in the Middle East and South West Asia held at Persepolis, Iran 24-30 May 1975. International Union for the Conservation of Nature and Natural Resources Publications, new series,

34:114-132.

Harrison, J. V. 1937. The history of the river system of South Iran. International Geological Congress, XVII Session, Moscow and Leningrad, pp. 227-228.

Harrison, J. V. 1941. The Jaz Murian depression, Persian Baluchistan. Geographical Journal, 101(5/6):206-225.

Harrison, J. V. 1942. The Shatt-el-Arab. Journal of the Royal Central Asian Society, 29(1):43-51.

Harrison, J. V. 1968. Geology, pp. 111-185. In: Fisher, W. B. (Ed.). The Cambridge History of Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. ix + 784 pp.

Harrison, J. V., Sherwin-White, A. N. and Mason, K. 1945. Persia. Geographical Handbook Series, Naval Intelligence Division, London. xix + 638 pp., 1 map.

Harsij, M. 2017. The possibility of using slaughterhouse wastewater for culture of common carp fish (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 6(2):11-19. In Farsi.

Harsij, M., Abbasi, M. and Hosseinifar, H. 2020. The effect of diet containing different levels of sodium butyrate on growth indices and blood factors in common carp (*Cyprinus carpio* Linnaeus, 1758). Journal of Applied Ichthyological Research, 8(2):43-50. In Farsi.

Harsij, M. and Adineh, H. 2017. Feasibility study on common carp (*Cyprinus carpio*) culture in refined waste water from poultry slaughterhouse: study of water quality, growth performance and body composition. Journal of Aquaculture Development, 11(3):123-135. In Farsi.

Hartl, M. 1979. Das Najafabadtal: Geographische Untersuchung einer Kanatlandschaft im Zagrosgebirge (Iran). Regensburger Geographische Schriften, 12:172 pp., 24 Fotos, 10 Karte.

Harwit, M. 1990. From qanats to qantas. Air and Space, August/September, 1990:4.

Hasanabadizadeh, Z., Hajimoradlou, A. A., Ghorbani, R., Khoshbavar Rostami, H. A. and Soleymani, N. 2008. The effects of vitamins injection (A, C, A+C and AD3E) on wound healing process and some hematological response in common carp, *Cyprinus carpio*. Journal of Agricultural Sciences and Natural Resources, 15(6):117-124. In Farsi.

Hasani, O. and Javadian, S. R. 2016. Effect of encapsulated bitter orange peel extract and BHT on the quality of common carp fillet during refrigerated storage. International Journal of Food Engineering, 12(3):303-310.

Hasani, Sh., Alizadeh Doughikollaee, E., Hayati Jafar Beygi, E. and Kamyab Yeghaneh, M. 2012. Quality of fish finger produced from common carp (*Cyprinus carpio*) during storage time at 4°C. Journal of Fisheries (Iranian Journal of Natural Resources), 65(2):169-181. In Farsi.

Hasani, Sh. And Hasani, M. 2014. Antimicrobial properties of grape extract on common carp (*Cyprinus carpio*) fillet during storage in 4 ºC. International Journal of Fisheries and Aquatic Studies, 1(3):130-136.

Hasankhani, M., Keivany, Y., Daliri, M., Pouladi, M. and Soofiani, N. M. 2014. Length-weight and length-length relationships of four species (*Barbus lacerta* Heckel, 1843), *Oxynoemacheilus angorae* (Steindachner, 1897), *Squalius lepidus* (Heckel, 1843) and *Pseudorasbora parva* (Temminck & Schlegel, 1846) from the Sirwan River (western Iran). Journal of Applied Ichthyology, 30(1):206-207.

Hasankhani, M., Keivany, Y., Jabaleh, A., Pouladi, M. and Soofiani, N. M. 2019. A study on abundance and biodiversity of fishes in Sirvan River in Kurdistan. Journal of Applied

Ichthyological Research, 6(3):35-50. In Farsi.
Hasankhani, M., Keivany, Y., Raeisi, H., Pouladi, M. and Soofiani, N. M. 2013. Length-weight relationships of three cyprinid fishes from Sirwan River, Kurdistan and Kermanshah provinces in western Iran. Journal of Applied Ichthyology, 29(5):1170-1171.
Hasanpoor, Sh., Eagderi, S., Nasri, M. and Jalali Roshan, S. 2015. Phenotype plasticity analysis of *Alburnus mossulensis* Heckel, 1843 from Tigris basin using geometric morphometrics. Journal of Fisheries, 9(2):63-73. In Farsi.
Hasanpour, F., Hoseini, E., Motalebi, A. A. and Darvish, F. 2012. Effects of soy protein concentrate and xanthan gum on physical properties of silver carp (*Hypophthalmichthys molitrix*) surimi. Iranian Journal of Fisheries Sciences, 11(3):518-530, vi.
Hasanpour, S., Eagderi, S., Amiri, B. M. and Moradi, M. 2016. Skeletal development of the caudal complex in Caspian roach, *Rutilus caspicus* (Yakovlev, 1927) (Teleostei: Cyprinidae). Biharean Biologist, 10 (1):16-19.
Hasanpour, S., Eagderi, S. and Nasri, M. 2014. Phenotypic plasticity in five populations of Mosul bleak (*Alburnus mossulensis*) from Tigris basin using Elleptic (*sic*) Fourier Analysis. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Hasanpour, S., Eagderi, S. and Nasri, M. 2016. Morphological comparison of five populations of Mosul bleak (*Alburnus mossulensis*) in the Tigris basin using Elliptic Fourier Analysis. Journal of Applied Biology, 30(2):76-87. In Farsi.
Hasanpour, S. H., Eagderi, S. and Mojezi Amiri, B. 2015. Osteological development of the vertebral column, paired, dorsal, and anal fins in *Rutilus caspicus*, Pravdin (1927) (Teleostei: Cyprinidae). Caspian Journal of Environmental Sciences, 13(3):209-221.
Hasanzadeh Kiabi, B., Madjnonian H., Goshtab Meygouni, H. and Mansori, J. 2004. Criteria for assessing the conservation status of Iranian wetland. Journal of Environmental Studies, 30(33):74-89. In Farsi.
Hasebi, Z., Motamedzadegan, A., Madani, R. and Zamani, A. 2019. Extraction and purification of trypsin from intestine of Caspian kutum (*Rutilus frisii kutum*) and calculation of its kinetic parameters and half life. Iranian Scientific Fisheries Journal, 28(5):101-110. In Farsi.
Hashemi, H. S. 2001. Caspian Phoca (seal), Green Wave, Tehran, 5:14-17. In Farsi (In English at www.netiran.com/Htdocs/WeeklyJournal/Social/wj00685.html, downloaded 5 November 2001).
Hashemi, M. 2008. An Independent Review: The Status of Water Resources in the Lake Uromiyeh Basin. A Synthesis Report for the GEF/UNDP Conservation of Iranian Wetlands Project, School of Civil Engineering and Geosciences, Newcastle University, England. 69 pp.
Hashemi, R. A., Jaddi, Y., Sadeghi, M. A., Ghiamati, S. and Motazedi, M. 2017. Study of toxicological effects of herbicide paraquat on haematological parameters of *Mesopotamichthys sharpeyi*. Open Journal of Marine Science, 7(2):258-270.
Hashemi, S., Eskandary, Gh., Ansary, H. and Yooneszadeh, M. 2011. Stock assessment and production of fish species in the Shadegan Wetland, Iran. World Journal of Fish and Marine Sciences, 3(6):502-508.
Hashemi, S., Ghorbani, R., Kymaram, F., Hossini, S. A., Eskandari, G. and Hedayati, A. 2016. Relationship of physicochemical factors with fish biomass and production in Shadegan Wetland, Iran. Biodiversitas, 17(2):515-522.

Hashemi, S., Hedayati, A., Ghorbani, R., Jabaleh, A. and Gandomkar, H. 2017. Growth and mortality parameters of common carp, (*Cyprinus carpio* Linnaeus, 1758) in Shadegan wetland. Journal of Wetland Ecobiology, 9(1):5-16, 115. In Farsi.

Hashemi, S., Mortezavi, A. and Kashi, M. 2010. Population dynamics and assessment of *Barbus grypus* (Heckel, 1843) and *Barbus barbulus* (Heckel, 1847) in Karoon River. Research Journal of Fisheries and Hydrobiology, 5(2):119-128.

Hashemi, S., Mortezavi, A. and Kashi, M. 2011. Population dynamics and assessment of *Barbus Gyrpus* (*sic*) (Heckel, 1843) and *Barbus Barbulus* (Heckel, 1847) in Karoon River. Research Journal of Fisheries and Hydrobiology, 6(1):7-16.

Hashemi, S. A., Eskandary, Gh. and Sedaghat, S. 2013. Length-weight relationships of *Aspius vorax* (Heckel, 1843) (Cyprinidae) in the Shadegan Wetland, Iran. World Journal of Fish and Marine Sciences, 5(1):100-103.

Hashemi, S. A., Ghorbani, R., Kaymaram, F., Hossini, S. A., Eskandari, G. and Hedayati, A. 2015. Some biological aspects of *Mesopotamichthys sharpeyi* in Shadegan Wetland, Iran. Iranian Scientific Fisheries Journal, 23(3):119-129. In Farsi.

Hashemi, S. A., Ghorbani, R., Kaymaram, F., Hossini, S. A., Eskandari, Gh. and Hedayati, A. 2014. Population dynamic parameters of common carp (*Cyprinus carpio*) in the Shadegan wetland. Applied Science Reports, 8(3):179-184.

Hashemi, S. A., Ghorbani, R., Kymaram, F., Hossini, S. A., Eskandari, G. and Hedayati, A. 2015. Fish species composition, distribution and abundance in Shadegan Wetland. Fisheries and Aquaculture Journal, 6(2):8 pp.

Hashemi, S. A., Ghorbani, R., Kymaram, F., Hossini, S. A., Eskandary, G. and Hedayati, A. 2016. Some biological characteristics of *Leuciscus vorax* (Heckel, 1843) in Shadegan wetland. Journal of Applied Ichthyological Research, 4(2):1-13. In Farsi.

Hashemi, S. A., Ghorbani, R., Kymaram, F., Hossini, S. A., Eskandari, Gh. and Hedayati, A. 2014. Estimation of fish composition and catchability coefficient of gillnet in the Shadegan Wetland. Iranian Journal of Ichthyology, 1(1):51-60.

Hashemi, S. A., Taghavi Motlagh, S. A., Hedayati, A. and Fazli, H. 2019. Fishing-in-balance, mean trophic level, ratio of pelagic and demersal fish landings and piscivory indices of coastal fisheries landings in Iranian part of Caspian Sea. Iranian Journal of Ichthyology, 6(1):112-122.

Hashemi, S. A. R. 2010a. Survey growth parameters of fish species in the Shadegan wetland. National Wildlife Conference, Azad University, Ahvaz, March 2010. 14 pp. In Farsi.

Hashemi, S. A. R. 2010b. Study of some biology characteristics of fish main species in the Shadegan wetland. National Wildlife Conference, Azad University, Ahvaz, March 2010. 13 pp. In Farsi.

Hashemi, S. A. R. 2016. Biodiversity of fish freshwater ecosystem: Shadegan Wetland. LAP Lambert Academic Publishing, Saarbrücken, Germany. 74 pp.

Hashemi, S. A. R. and Ansary, H. 2012. Biomass and production of fish species in the Shadegan Wetland, Iran. Global Veterinaria, 9(2):123-128.

Hashemi, S. A. R. and Eskandary, Gh. R. 2013. Stock assessment and fish production in the Shadegan wetland in Khuzestan province. Journal of Animal Researches (Iranian Journal of Biology), 26(2):218-227. In Farsi.

Hashemi, S. A. R., Eskandary, Gh. and Ansary, H. 2010a. Study of catch and biomass of fish species in the Shadegan wetland. National Wildlife Conference, Azad University, Ahvaz, March 2010. 11 pp. In Farsi.

Hashemi, S. A. R., Eskandary, Gh. and Ansary, H. 2010b. Study of catch and biomass of fish species in the Shadegan wetland. Journal of Wetland Ecobiology, 1(4):3-9. In Farsi.

Hashemi, S. A. R., Eskandary, Gh. and Ansary, H. 2012. Biomass of fish species in the Shadegan Wetland, Iran. Research Journal of Recent Sciences, 1(1):66-68.

Hashemi, S. A. R. and Mortazavi, S. A. 2011. Population dynamics of *Barbus grypus* (Heckel, 1843) and *Barbus barbulus* (Heckel, 1847) in Karoon River, south-west Iran. Iranian Scientific Fisheries Journal, 20(3):155-166. In Farsi.

Hashemi, S. A. R., Mortezavi, S. A. S. and Kashi, M. T. 2010. Population dynamics of *Barbus grypus* (Heckel, 1843) and *Barbus barbulus* (Heckel, 1847) in Karun River. National Wildlife Conference, Azad University, Ahvaz, March 2010. 15 pp. In Farsi.

Hashemi, S. A. R., Stara, A. and Faggio, C. 2019. Biological characteristics, growth parameters and mortality rate of *Carassius auratus* in the Shadegan Wetland (Iran). International Journal of Environmental Research, 13(3):457-464.

Hashemi, S. M. 2021a. A look at the need to create marine protected areas (MPAs) for the sustainability of the Caspian Basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Hashemi, S. M. 2021b. Conservation of riverine functions of Caspian watersheds focusing on the structural significance at landscape level. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Hashemi Kaverdi, Z., Tehranifard, A. and Zamini, A. 2017. The effect of oral administration of silymarin on biochemical parameters of blood and immune system in *Abramis brama orientalis*. Journal of Animal Environment, 9(1):253-262. In Farsi.

Hashemian Kafshgari, A. 2009. Hydrology and hydrobiology and environmental pollutions in lower than 10 meters depths of Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 111 pp. In Farsi.

Hashemipour, S. A. A. and Khodadadi, M. 2017. The study of sperm morphology and some chemical variables in seminal plasma of Barbubs (*sic*) barbulus Heckel, 1847. Journal of Animal Environment, 9(1):209-216. In Farsi.

Hashemzadeh Segherloo, I. 2015. Identification of qanat fishes in Taft and Mehriz (Yazd-Iran) via DNA barcoding. Journal of Aquatic Ecology, Hormozgan University, 5(1):113-120. In Farsi.

Hashemzadeh Segherloo, I., Ghojoghi, F., Narjes Tabatabaei, S., Normandeau, E., Hernandez, C., Hallerman, E., Boyle, B. and Bernatchez, L. 2021. Population genomics of the southern Caspian Sea vobla *Rutilus lacustris*. Hydrobiologia, 848(2):345-361.

Hashemzadeh Segherloo, I., Narjes Tabatabaei, S., Ghaed Rahmati, N., Amiri, M. and Bernatchez, L. 2020. The analysis of the relationship between Lorestan cave barbs (*Garra typhlops* and *Garra lorestanensis*) and *Garra gymnothorax* populations in Dez and Karkheh River drainages. Nova Biologica Reperta, 7(1):1-8. In Farsi.

Hashemzadeh Segherloo, L. and Abdoli, A. 2015. Analysis of the phylogenetic and geographic relationships of *Capoeta* species in some basins of Iran. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 207.

Hashemzadeh Segherloo, L., Abdoli, A., Eagderi, S., Esmaeili, H. R., Sayyadzadeh, G., Bernatchez, L., Hallerman, E., Geiger, M. F., Özulug, M., Laroche, J. and Freyhof, J. 2017. Dressing down: convergent reduction of the mental disc in *Garra* (Teleostei:

Cyprinidae) in the Middle East. Hydrobiologia, 785(1):47-59.
Hashemzadeh Segherloo, L., Abdoli, A., Purahmad, R., Puria, M. and Golzarianpour, K. 2014. Genetic barcoding of *Capoeta* species in Karoon and Tigris tributaries. Modern Genetics Journal, 9(2):171-178. In Farsi.
Hashemzadeh Segherloo, L., Bernatchez, L., Golzarianpour, K., Abdoli, A., Primmer, C. R. and Bakhtiary, M. 2012. Genetic differentiation between two sympatric morphs of the blind Iran cave barb *Iranocypris typhlops*. Journal of Fish Biology, 81(5):1747-1753.
Hashemzadeh Segherloo, L., Normandeau, E., Benestan, L., Rougeux, C., Coté, G., Moore, J-S., Ghaedrahmati, N., Abdoli, A. and Bernatchez, L. 2018. Genetic and morphological support for possible sympatric origin of fish from subterranean habitats. Scientific Reports, 8:2909.
Hashemzadeh Segherloo, L., Rahmati, S., Abdoli, A., PourAhmad, R. and Golzarianpour. K. 2013. Analysis of the mitochondrial systematic relationships between blind Iran cave barb (Cyprinidae: *Iranocypris typhlops*) and *Garra* spp. in Zagros region. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 91 (abstract).
Hashemzadeh Segherloo, L., Rahmati, S., Purahmad, R., Golzarianpour. K. and Abdoli, A. 2013. Analysis of the systematic status of the blind Iran cave barb, *Iranocypris typhlops*, using COI gene. Modern Genetics Journal, 8(1)(32):59-66. In Farsi.
Hashemzadeh Segherloo, L., Tabatabaei, S. N., Mansouri, A., Abdoli, A., Ghalenoei, M. and Golzarianpour, K. 2015. Length-weight relationships of *Garra rufa*, in the Tigris and Persian Gulf basins of Iran. International Journal of Aquatic Biology, 3(1):25-27.
Hashemzadeh Segherloo, L., Tabatabaei, S. N. and Mansouri Khajehlangi, A. 2014. The Iranian activities in conservation of subterranean fishes. Newsletter of the IUCN SSC/WI Freshwater Fish Specialist Group, 7:24-25.
Hassan, P. Q., Qashem, Z. F. and Rahimian, H. 2008. First record of three metazoan parasites in cyprinid fishes (Cyprinidae) in Tadjan and Babol-Rud rivers. Tehran University Journal, 30(3):529-540.
Hassan Nataj Niazi, E., Imanpour, M. R., Zad Majid, V. and Taghizaheh, V. 2013. Effects of crowding stress on growth indices and survival rate of goldfish (*Carassius auratus*). Breeding and Aquaculture Sciences Quarterly, 1(2):33-44. In Farsi.
Hassani, J. 2021. Protecting the habitats of native fish in Guilan province in the light of the strategies of the Iranian criminal justice system. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.
Hassantabar, F., Oraji, H., Esmaeili, A. and Babaei, S. 2013. The study on the activities of digestive enzymes, amylase and alkalyn phosphatase, in kutum larvae fed by *Artemia* nauplii. Journal of Animal Biology, 5(2):25-33. In Farsi.
Hassanatabar, F., Ouraji, H., Esmaeili, A. and Babaei, S. S. 2013. Study of the activities of digestive enzymes, amylase and alkaline phosphatase, in kutum larvae *Rutilus frisii kutum* fed Artemia nauplii. World Journal of Fish and Marine Sciences, 5(3):266-270.
Hassanpour, M., Rajaei, G., Sinka Karimi, M. H., Ferdosian, F. and Maghsoudloorad, R. 2014. Determination of heavy metals (Pb, Cd, Zn and Cu) in Caspian kutum (*Rutilus frisii kutum*) from Miankaleh International Wetland and human health risk. Journal of Mazandaran University of Medical Sciences, 24(113):163-170. In Farsi.
Hassanpour, S., Sarvi Moghanlou, K., Razi, M. and Imani, A. 2021. Alterations in growth

indices and body composition of goldfish (*Carassius auratus*) fed on diets contaminated with different levels of aflatoxin B1 and zearalenone toxins. Journal of Fisheries (Iranian Journal of Natural Resources), 74(1):153-163. In Farsi.

Hassanpour Yasaghi, S., Patimar, R., Ghorbani, R. and Golzarianpour, K. 2015. Comparison of length-weight and condition factor in populations of *Hemiculter leucisculus* (Basilewsky, 1855) in Golestan dam, Iran. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 56.

Hassantabar, F., Esmaeili Fereidouni, A., Ouraji, H., Babaei, S. and Hosseini, F. 2015. Effect of initial stocking density and diet type on growth indices and survival rate of the Caspian kutum (*Rutilus kutum*) larvae. Journal of Oceanography, 6(21):1-9. In Farsi.

Hassanzadeh Saber, M., Baradaran Noveiri, S., Pourkazemi, M., Nowruzfashkhami, M., Yarmohammadi, M. and Kashani Sabet, A. 2011. DNA markers in hybrids of female Caspian kutum *Rutilus frisii kutum* and male grass carp *Ctenopharyngodon idella*: possible production of gynogenic progeny. Progress in Biological Sciences, Tehran, 1(1):49-54.

Hassanzadeh Saber, M. and Pourkazemi, M. 2012. Induction of triploidy in grass carp *Ctenopharyngodon idella* Valenciennes, 1844: Comparison of cold & heat shocks. Caspian Journal of Environmental Sciences, 10(2):195-204.

Hasselquist, F. 1757. Iter Palaestinum eller Resa til Heliga Landet Förrättad ifrån År 1749 till 1752 Utgiven av Carl Linnaeus (Iter Palaestinum or A Voyage to the Holy Land Undertaken from the Year 1749 to 1752 Published by Carl Linnaeus in 1757). Rediviva Publishing House, Stockholm (1969 Reprint).

Hatami, H. 1998. Age structure and growth of *Capoeta capoeta gracilis* in Tilabad River. B.Sc. Seminar, Agricultural Sciences and Natural Resources University, Gorgan. 85 pp. In Farsi.

Hatami, H. and Sieyahchehreh, M. 2012. Investigating the effects of ethidium bromide on some hematological parameters in *Cyprinus carpio*. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 6(1):33-40. In Farsi.

Hatefi, S., Sudagar, M., Hajibeglou, A. and Harsij, M. 2017. Effect of triploidy on growth factors and body abnormalities in koi fish (*Cyprinus carpio*). Journal of Aquaculture Sciences, 5(6):1-9. In Farsi.

Hatefi, S., Sudagar, M., Hajibeglou, A. and Harsij, M. 2020. Effects of triploidy induction using heat shock on the hatching, survival and triploid rate of ornamental koi (*Cyprinus carpio*) larvae. Journal of Animal Environment, 11(4):249-256. In Farsi.

Hatton, E. C., Buckley, J. D., Fera S., Henry, S., Hunt, L. M., Drake, D. A. R. and Johnson, T. B. 2018. Ecological temperature metrics for invasive fishes in Ontario and the Great Lakes Region. Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, Science and Research Information Report, IR-15:27 pp., appendices.

Hayatbaksh, M., Khara, H., Sayadborani, M., Daghigh Roohi, J., Ahmadnezhad, M. and Rahabar, M. 2012. The relationship between parasitic infection and some hematological parameters of (*Abramis brama orientalis*) caught off the Caspian Sea part of Anzali coast. Journal of Wetland Ecobiology, 3(10):23-30. In Farsi.

Hayatbakhsh, M. R., Khara, H., Movahed, R., Sayadborani, M., Daghigh Rohi, J., Ahmadnezhad, M., Rahbar, M. and Sajedi Rad, A. 2014. Haematological characteristics associated with parasitism in bream, *Abramis brama orientalis*. Journal of Parasitic

Diseases, 38(4):383-388.

Hayatbakhsh, M. R., Khara, H., Rahabar, M. and Ahmadnezhad, M. 2011. Parasite infection of bream (*Abramis brama orientalis*) in the Caspian Sea (Bandar Anzali coast). International Conference on Chemical, Environmental and Biological Sciences (ICCEBS'2011), pp. 320-323

Hayatbakhsh, M. R., Khara, H., Saied Bourani, M., Ahmad Nejad, M., Daghigh Rouhi, J., Movahed, R. and Rahbar, M. 2010. A survey of some hematological parameters of *Abramis brama orientalis* in the Caspian Sea (Bandar Anzali coast in Iran). Journal of Biology Science, 4(2)(series no. 13):47-57. In Farsi.

Hayatbakhsh, M. R., Khara, H., Sayyad Borani, M., Daghigh Rouhi, J., Rahbar, M., Ahmadnezhad, M. and Movahed, R. 2012. Parasite infection in *Abramis brama orientalis* in the Bandar Anzali coast during fishing season of 2008-2009. Journal of Fisheries, 6(2)(22):53-64. In Farsi.

Hayati-Jafar Beigi, E., Doughikollaee, E. A., Rahimabadi, E. Z. and Elahi, M. Y. 2014. Effect of different cooking processes on the fatty acid profile of grass carp (*Ctenopharyngodon idella*) fillets during chill storage. International Journal of Aquatic Biology, 2(5):223-228.

Haynes, S. J. 1981. Towards a paleogeography and tectonic evolution of Iran: Discussion. Canadian Journal of Earth Sciences, 18(11):1763-1764.

Heckel, J. J. 1843a. Abbildungen und Beschreibungen der Fische Syriens nebst einer neuen Classification und Characteristik sämmtlicher Gattungen der Cyprinen. Stuttgart, 109 pp.

Heckel, J. J. 1843b. Ichthyologie. In: Russegger, J. Reisen in Europa, Asien und Afrika, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in den Jahren 1835 bis 1841 von Joseph Russegger. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart, 1(2):991-1099, Taf. II-XIII (separate but identical version of the above).

Heckel, J. J. 1847a. Naturhistorischer Anhang. In: Russegger, J. Reisen in Europa, Asien und Afrika, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in den Jahren 1835 bis 1841 von Joseph Russegger. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart, 2(3):207-254, Taf. XIV-XXI.

Heckel, J. J. 1847b. Anhang. Die Fische Persiens gesammelt von Theodor Kotschy. In: Russegger, J. Reisen in Europa, Asien und Afrika, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in den Jahren 1835 bis 1841 von Joseph Russegger. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart, 2(3):255-272, Taf. XXII.

Heckel, J. J. 1847c. Nachtrag zur Charakteristik und Classifikation der Cyprineen-Gattungen. In: Russegger, J. Reisen in Europa, Asien und Afrika, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in den Jahren 1835 bis 1841 von Joseph Russegger. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart, 2(3):273-290.

Heckel, J. J. 1847d. Index. Addenda et Corrigenda. In: Russegger, J. Reisen in Europa, Asien und Afrika, mit besonderer Rücksicht auf die naturwissenschaftlichen Verhältnisse der betreffenden Länder, unternommen in den Jahren 1835 bis 1841 von Joseph Russegger. Schweitzerbart'sche Verlagsbuchhandlung, Stuttgart, 2(3):347-360.

Heckel, J. J. and Kner, R. 1858. Die Süsswasserfische der Oesterreichischen Monarchie mit Rücksicht auf die angrenzenden Länder. Leipzig. 388 pp., 204 figs.

Hedari Salkhordeh, M. R., Gharaei, A. and Mirdar Harijani, J. 2016. First record of karyotype

analysis in anjak, *Schizocypris altidorsalis* (Bianco and Banarescu, 1982) from Hamoun Lake, Iran. Iranian Journal of Fisheries Sciences, 15(1):246-254.

Hedayati, A. 2016. Toxicological effects of heavy metal cadmium on two aquatic species: *Rutilus rutilus* and *Hypophthalmichthys molitrix*. Journal of Earth, Environment and Health Sciences, 2(2):66-69.

Hedayati, A. and Bagheri, T. 2016. Toxicity effects of titanium nano particles on blood indices in goldfish (*Carassius auratus*). FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Hedayati, A. and Darabitabar, F. 2015. Study of mortality responses of common carp (*Cyprinus carpio*) during exposure to commercial gasoline. Breeding and Aquaculture Sciences Quarterly, 2(5):73-80. In Farsi.

Hedayati, A., Darabitabar, F. and Bagheri, T. 2016. Hematological, immunological and biochemical lesions of Caspian roach (*Rutilus caspicus*) in response to heavy metal lead. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Hedayati, A., Darabitabar, F., Bagheri, T., Hedayati, E. and Van Doan, H. 2018. Histopathological impairment of common carp (*Cyprinus carpio*) induced through povidone-iodine exposure. Microscopy Research and Technique, 81(11):1257-1260.

Hedayati, A., Darabitabar, F. and Rezaei, H. 2017. Histopathological study of gill in common carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*) during exposure to lethal concentrations of nano-zinc oxide, nano copper oxide and nano titanium dioxide. Veterinary Clinical Pathology (Veterinary Journal Tabriz), 11(2):135-144. In Farsi.

Hedayati, A., Darabitabar, F., Shaluei, F., Ghaffari, Z. and Kashiri, A. 2016. Evaluation of silver carp (*Hypophthalmichthys molitrix* Valenciennes, 1844) mortality rate in the face of lethal concentrations of commercial gasoline. Journal of Fisheries Sciences, 10(4):4-8.

Hedayati, A. and Ghafari, H. 2014. Study on lethal effects of chlorine bleach disinfector soluble on bighead carp (*Hypophthalmichthys nobilis*) and goldfish (*Carassius auratus*). Breeding and Aquaculture Sciences Quarterly, 2(2):93-102. In Farsi.

Hedayati, A., Hoseini, S. M. and Ghelichpour, M. 2014, Acute toxicity of waterborne manganese to *Rutilus caspicus* (Yakovlev, 1870) - gill histopathology, immune indices, oxidative condition, and saltwater resistance. Toxicological and Environmental Chemistry, 96(10):1535-1545.

Hedayati, A., Jaafari, O. and Nasrolah Pourmoghadam, M. 2014. Study on the hematological and biochemical change of silver carp (*Hypophthalmichthys molitrix* Valenciennes, 1884) (*sic*) during acute and sub-acute exposure of cadmium. Journal of Fisheries Science and Technology, 3(1):57-67. In Farsi.

Hedayati, A., Jahanbakhshi, A. and Moradzadeh, M. 2015. The effect of sub-acute concentration of nano-zinc oxide (ZnO NPS) on hematological indices of common carp (*Cyprinus carpio*). Journal of Experimental Animal Biology, 4(1):27-34. In Farsi.

Hedayati, A., Khani, F., Sharifian, M. and Khalili, M. 2016. The destructive effects of diazinon on gill tissue of Caspian roach fingerling (*Rutilus caspicus*). Journal of Aquatic Ecology, Hormozgan University, 6(2):145-151. In Farsi.

Hedayati, A. A. 2018. Effects of 2-phenoxyethanol (2-PE) anesthesia on some haematological and biochemical indices of silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Fisheries Sciences, 17(1):1-10.

Hedayati, S. A., Bagheri, T., Hoseinifar, S. H. and Van Doan, H. 2020. Growth performances

and hemato-immunological responses of common carp (*Cyprinus carpio* Linnaeus, 1758) to fermented Aspergillus oryzae. Iranian Journal of Fisheries Sciences, 19(4):1749-1756.

Hedayati, S. A. and Darabitabar, F. 2017. Different concentrations of vertimec in the gastrointestinal tissue of common carp (*Cyprinus carpio*) fed isomaltooligosaccharide. Journal of Aquaculture Sciences, 5(1):20-26. In Farsi.

Hedayati, S. A., Ghafari Farsani, H. and Gerami, M. H. 2016a. Length-weight relationships of two fish species from Gamasiab Reservoir, western Iran: *Alburnus mossulensis* Heckel, 1843 and *Luciobarbus esocinus* Heckel, 1843. Journal of Applied Ichthyology, 32(1):139-140.

Hedayati, S. A., Ghafari Farsani, H. and Gerami, M. H. 2016b. Morphometric variations among three populations of *Alburnus zagrosensis* (Coad, 2009) (*sic*) in the Zagros Mountain basin, Iran. Proceedings of the National Academy of Science, India, Section B: Biological Sciences, 88(3):859-866.

Hedayati, S. A. and Jahanbakhshi, A. 2017. Sub-lethal effects of nano zinc oxide (ZNO NPS) on some hematological indices of goldfish (*Carassius auratus*). Journal of Environmental Science and Technology, 19(1):211-219. In Farsi.

Hedayati, S. A., Jebeleh, A. R. and Jahanbakhshi, A. 2016. Detection of lethal concentration (LC50) of diazinon in silver carp (*Hypophthalmichthys molitrix*) and roach (*Rutilus rutilus*). Journal of Aquatic Ecology, Hormozgan University, 6(3):138-143. In Farsi.

Hedayati, S. A. A. and Jebaleh, A. 2015. Prioritize the factors determining the lethal concentration (LC5096H) cadmium chloride in common carp (*Cyprinus carpio*) and golden goldfish (*Carassius auratus*). Breeding and Aquaculture Sciences Quarterly, 3(6):93-102. In Farsi.

Hedayati, S. A. A., Khalili, M. and Ghaffari Farsani, H. 2014. Investigating histopathological lesions of gill tissue in goldfish (*Carassius auratus* Linnaeus, 1758) during sub-lethal exposure to cadmium chloride. Journal of Applied Ichthyological Research, 2(2):33-40. In Farsi.

Hedayatifard, M. 2003. Fish and Shrimp Processing Technology. Persia Fishing Industries Company, Tehran. 120 pp.

Hedayatifard, M. 2016. Sensory, chemical, microbal load and fatty acid composition changes of silver carp (*Hypophthalmichthys molitrix*) after thermal drying process, vacuum packaging and holding in 4ºC. Iranian Scientific Fisheries Journal, 24(4):127-143. In Farsi.

Hedayatifard, M., Ariaei, P. and Hassani-Moghadam, E. 2016. Effect of cold-smoking on the production of polycyclic aromatic hydrocarbons (PAHs), quality indices, microbial community and omega-3 fatty acid profile of common carp *Cyprinus carpio*. Journal of Fisheries Science and Technology, 5(3):73-93. In Farsi.

Hedayatifard, M., Kavousi, S. A. and Khavarpour, M. 2016. Comparative study of chemical, sensory and microbal attributes of fried and cooked marinades of silver carp (*Hypophthalmichthys molitrix*) during storage at 4ºC. Journal of Veterinary Research, 71(4):437-446. In Farsi.

Hedayatifard, M. and Miri, S. M. 2017. Changes of lipid oxidation indices and fatty acids composition of salted fillet of grass carp *Ctenopharyngodon idella* affected by methods of cooking. Iranian Scientific Fisheries Journal, 26(4):57-72. In Farsi.

Hedayatifard, M. and Nemati, S. 2009. Changes of roe fatty acids of kutum *Rutilus frisii kutum* and golden muller Liza aurata affected by salting. Journal of Fisheries, 3(2):1-10. In

Farsi.
Hedayatifard, M. and Pourmolaei, N. 2016. Study of quality indices, microbial load and fatty acid composition of smoked kutum and golden mullet in the northern Iranian markets. Iranian Journal of Food Science and Technology, 13(57):145-158. In Farsi.
Hedayatifard, M. and Ramezani, H. 2007. Applied Ichthyology. Islamic Azad University, Ghaemshahr. xii + 206 pp. In Farsi.
Hedayatifard, M. and Rezaei, N. 2016. Quality changes, bacterial community and shelf life of fish fingers of big-head carp *Aristichthys nobilis* during storage at -18ºC. Journal of Experimental Animal Biology, 5(2):97-109. In Farsi.
Heidari, A., Khoshkholgh, M. and Mousavi-Sabet, M. 2014. Tracing the effects of Sefidrud dams on *Capoeta gracilis* (Cyprinidae) populations using Truss distances in southern Caspian Sea basin. Iranian Journal of Ichthyology, 1(2):106-113.
Heidari, A., Mousavi, H., Khoshkholgh, M. R. and Esmaeili, H. R. 2013. Morphometric and meristic characteristics of a population of *Capoeta capoeta* (Pisces: Cyprinidae) in the Sefidroud River, from the southern Caspian Sea basin. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Heidari, A., Mousavi-Sabet, H., Khoshkholgh, M. and Esmaeili, H. R. 2014. Morphometric and meristic comparison of *Capoeta capoeta* (Güldenstaedt, 1773) from upstream and downstream of the Manjil Dam and downstream of Tarik Dam in Sefidroud River. Journal of Fisheries, 67(2):207-222. In Farsi.
Heidari, A., Mousavi-Sabet, H., Khoshkholgh, M., Esmaeili, H. R. and Eagderi, S. 2013. The impact of Manjil and Tarik dams (Sefidroud River, southern Caspian Sea basin) on morphological traits of siah mahi *Capoeta gracilis* (Pisces: Cyprinidae). International Journal of Aquatic Biology, 1(4):195-201.
Heidari, A., Mousavi-Sabet, H., Khoshkholgh, M., Esmaeili, H. R. and Habibi, A. 2014. Length-weight and length-length relationships of siah mahi (Cyprinidae: *Capoeta gracilis*), in Sefidroud River of the southern Caspian Sea basin. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Heidari, B., Abdzadeh, E. and Nazarhaghighi, F. 2014. Study on stress indices in the acute and sub-acute response of *Carassius auratus* to the aquatic pollutants. Experimental Animal Biology, 2(1):21-32. In Farsi.
Heidari, B., Ahmadpour, M. and Amani, R. 2019. Changes in metabolic indexes (*sic*) of the Caspian kutum fry in acute and subacute exposure to the nanoparticle of copper oxide and silver nanocolloid. Journal of Experimental Animal Biology, 8(2):51-67. In Farsi.
Heidari, B., Avarjeh, S. and Taghavi Jelodar, H. 2015. The combined effects of gradual changes in salinity and temperature on gill tissue of common carp (*Cyprinus carpio*). Journal of Experimental Animal Biology, 4(2):25-35. In Farsi.
Heidari, B. and Farzadfar, F. 2017. Effects of temperature and gonadal growth on the lysozyme level of immune tissues in the male and female Caspian kutum (*Rutilus frisii kutum*). Aquaculture Research, 48(2):377-385.
Heidari, B., Golchinrad, A., Haghi, N. and Yavari, L. 2013. Study on physiological responses of silver carp (*Hypophthalmichthys molitrix*) exposed to the anionic detergents. Journal of Oceanography, 4(14):69-76. In Farsi.
Heidari, B., Roozati, S. A. and Yavari, L. 2010. Changes in plasma levels of steroid hormones during oocyte development of Caspian kutum (*Rutilus frisii kutum*, Kamensky, 1901).

Animal Reproduction, 7(4):373-381.

Heidari, B., Shabanipour, N. and Savari, A. 2010. Plasma osmotic variations during developmental stages of the Caspian kutum oocyte (*Rutilus frisii kutum*). Iranian Journal of Biology, 23(4):560-572. In Farsi.

Heidari, B., Shabanipour, N., Savari, A., Yavari, V. and Hosseini, N. 2009. The oocyte development of kutum, *Rutilus frisii kutum*, K. with special emphasis on the zona radiata structure. Animal Reproduction, 6(3):465-472.

Heidari, M., Ziyaei, K. and Hosseini, S. V. 2018. Thawing of silver carp (*Hypophthalmichthys molitrix*) frozen fillets by different brine concentrations: Evaluation of physico-chemical quality indices. Journal of Fisheries (Iranian Journal of Natural Resources), 71(2):103-111. In Farsi.

Heidari, N., Chelehmal, M. and Javaheri Baboli, M. 2018. The effect of adding stevia (*Stevia rebaudiana*) extract in the diet on the growth, survival and fillet chemical properties on common carp (*Cyprinus carpio*). Journal of Applied Biology, 31(3):55-67. In Farsi.

Heidari Chaharlang, B., Riyahi Bakhtiari, A., Jahangard Mohammadi, J. and Farshchi, P. 2019. Mapping of heavy metal, zinc, copper and iron contamination in surface sediments of Shadegan wildlife refuge using different methods of interpolation and GIS. Journal of Wetland Ecobiology, 11(3):85-102. In Farsi.

Heidari Kahkesh, G. and Chelkeh Mal Dezfooli Nejad, M. 2017. The growth performance of grass carp (*Ctenopharyngodon idella*) in the exposure of zinc oxide nanoparticles (2015). Journal of Wetland Ecobiology, 9(2):19-26, 110. In Farsi.

Heidarieh, M. and Sheikhzadeh, N. 2019. Effects of polyphenolic compound green tea catechin on growth performance, some biochemical and mucosal indices in crucian carp (*Carassius carassius*). Journal of Fisheries (Iranian Journal of Natural Resources), 72(3):259-269. In Farsi.

Hemmati, A. 2016. Investigating human and climate impact on Parishan Wetland water system using system dynamic approach, pp. 129-148. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Hensel, K. 1970. Review of the classification and of the opinions on the evolution of Cyprinoidei (Eventognathi) with an annotated list of genera and subgenera described since 1921. Annotationes Zoologicae et Botanicae, Slovenske narodne Museum, 57:1-43.

Hensel, K. 1978. Morphology of lateral-line canal system of the genera *Abramis*, *Blicca* and *Vimba* with regard to their ecology and systematic position. Acta Universitatis Carolinae, Biologica, 1975-1976:105-149, 2 figs.

Hermand, M., Moghaddas, F., Mahmoudi, S., Radkhah, A., Soleimani Rad, A. 2020. The effect of feeding times on the performance of growth, nutrition, survival and composition of koi (*Cyprinus carpio* var. koi (Linnaeus, 1758)). Journal of Aquatic Ecology, Hormozgan University, 9(2):108-118. In Farsi.

Herzenstein, S. 1888-1891. Nauchnye rezul'taty puteshestvii N. M. Przheval'skogo po Tsentral'noi Azii. III (2) Ryby. [Scientific Results of N. M. Przeheval'skii's Travels in Central Asia. III(2) Fishes]. Akademia Nauk, Sankt-Peterburg, 262 pp.

Herzig-Straschil, B. 1997. Franz Steindachner (1834-1919) and other prime contributors to the Ichthyological Collection of the Naturhistorisches Museum Wien, pp. 101-108. In: Pietsch, T. W. and Anderson, W. D. (Eds.). Collection Building in Ichthyology and Herpetology. American Society of Ichthyologists and Herpetologists, Special Publication, 3:xiii + 593 pp.

Herzog, P. 1967. Die Binnenfischerei im Irak. Die Fischwirt, 17(10):249-255.
Herzog, P. 1969. Untersuchungen über die Parasiten der Süßwasserfische des Irak. Archiv für Fischereiwissenschaft, 20(2-3):132-147.
Heshmatfar, F., Shabany, A., Hoseinifar, H. and Ghafari, H. 2020. Effects of singular or combined administration of formic acid and *Pediococcus acidilactici* on growth indices and resistance to salinity in common carp fingerling (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 9(3):83-91. In Farsi.
Heshmati, A., Karami-Momtaz, J., Nili-Ahmadabadi, A. and Ghadimi, S. 2017. Dietary exposure to toxic and essential trace elements by consumption of wild and farmed carp (*Cyprinus carpio*) and Caspian kutum (*Rutilus frisii kutum*) in Iran. Chemosphere, 173:207-215
Hesnentajenaaza, A., Imanpour, M. R. and Hedayati, S. A. A. 2015. Detection of acute toxicity test (LC50) pesticide chlorpyrifos in goldfish (*Carassius auratus*) and comparison of its toxicity with other organophosphate toxicity. Journal of Utilization and Cultivation of Aquatics, 3(4):1-12. In Farsi.
Heydari, I., Khara, H. and Vahabzadeh, H. 2014. Effect of sex hormone therapy on some blood cellular and biochemical factors in bighead carp (*Hypophthalmichthys nobilis*). Renewable Natural Resources Research, 4(4):15-23. In Farsi.
Heydari, M., Othman, F. and Noori, M. 2013. A review of the environmental impact of large dams in Iran. International Journal of Advancements Civil Structural and Environmental Engineering, 1(1):1-4.
Heydarnejad, M. S. 2009. Length-weight relationships for six freshwater fish species in Iran. Chinese Journal of Oceanology and Limnology, 27(1):61-62.
Heydarpour, E 1978. Erste Erfahrung mit dem Aufbau einer Karpfenteichwirtschaft im Iran. Österreichs Fischerei, 31(2-3), 46-48.
Higgins, R. P. 1973. Survey of pesticide residues and heavy metals in Caspian Sea biota from Bandarpahlavie, Iran. Oceanography and Limnology Program, Office of Environmental Sciences, Smithsonian Institution, Washington, D.C. Mimeo, 11 pp., including Winnett, G. Levels of DDT and related compounds in sturgeon, sturgeon caviar and other fish from the Caspian Sea near Bandarpahlavie, Iran. March and August, 1971. Attachment 1:i-iv and Straat, P. Attachment 2.
Hill, A. and Whybrow, P. J. 1999. Summary and overview of the Baynunah fauna, Emirate of Abu Dhabi, and its context, pp. 7-14. In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.
Hindi, M. J., Sarhan, H. R. and Al-Shatty, S. M. H. 1996a. Quality criteria of fresh carp, *Cyprinus carpio* and sbour, *Tenualosa ilisha*.1 - The chemical composition. Marina Mesopotamica, 11(2):251-261.
Hindi, M. J., Sarhan, H. R. and Al-Shatty, S. M. H. 1996b. Quality criteria of fresh carp, *Cyprinus carpio* and sbour, *Tenualosa ilisha*.2 - Chemical indices. Marina Mesopotamica, 11(2):263-272.
Hjrad Koochak, E., Patimar, R., Harsij, M. and Bahalkeh, A. 2020. Comparative study on reproductive characteristics of *Carassius gibelio* (Bloch, 1782) in Golestan and Voshmgir dam lake. Journal of Applied Ichthyological Research, 8(1):20-29. In Farsi.
Hoghoghi, M., Eagderi, S. and Shams-Esfandabad, B. 2015. Habitat use of *Alburnoides namaki* in the Jajroud River (Namak Lake basin, Iran). International Journal of Aquatic Biology,

3(6):390-397.
Hohenacker, R. F. 1845. Plantarum Persiae australis siccatarum species 440, collectae a Th. Kotschy, determinatae a Dre E. Boissier, editae a R. F. Hohenacker. 4pp., map (www.biodiversitylibrary.org/item/108318#page/5/mode/1up).
Holčík, J. (Ed.). 1989. The Freshwater Fishes of Europe. Volume 1, Part II. General Introduction to Fishes. Acipenseriformes. AULA-Verlag, Wiesbaden. 469 pp.
Holcik, J. 1992. New data from the ecology of *Rutilus frisii kutum* (Kamenskij 1901) juveniles. Proceedings of the Scientific Conference on Fish Reproduction '92, Vodnany, Czechoslovakia, 2-4 March, 1992, pp. 139-140.
Holcik, J. 1994. New data on the ecology of kutum *Rutilus frisii* Nordmann, 1840 from the Caspian Sea. VIII Congress Societas Europaea Ichthyologorum, Oviedo, Spain, September 26 to October 2, 1994, pp. 117-118 (abstract).
Holčík, J. 1995. New data on the ecology of kutum, *Rutilus frisii* (Nordmann, 1840) from the Caspian Sea. Ecology of Freshwater Fish, 4(4):175-179.
Holčík, J. and Duyvené de Wit, J. J. 1964. Systematic status of the bitterlings from Asia Minor and notes on the geographical variability of *Rhodeus sericeus* (Pallas, 1776) in the area of its distribution. Zeitschrift für Wissenschaftliche Zoologie, Leipzig, 169(3/4):396-412.
Holčík, J. and Jedlička, L. 1994. Geographical variation of some taxonomically important characters in fishes: the case of the bitterling *Rhodeus sericeus*. Environmental Biology of Fishes, 41(1-4):147-170.
Holcik, J. and Olah, J. 1990. Iran. Anzali Lagoon productivity and fish stock investigations. Progress Report from the Joint Mission (7 August to 14 September 1990). Food and Agriculture Organization, Rome, IRA/88/001, Working Document 3:9 pp., Appendix 1:1 p., Appendix 2:5 pp., Appendix 3:2 pp.
Holčík, J. and Oláh, J. 1992. Fish, fisheries and water quality in Anzali Lagoon and its watershed. Report prepared for the project - Anzali Lagoon productivity and fish stock investigations. Food and Agriculture Organization, Rome, FI:UNDP/IRA/88/001 Field Document 2:x + 109 pp.
Holčík, J. and Razavi, B. A. 1991. New species of freshwater fish from the Iranian coast of the Caspian Sea. Report prepared for the Anzali Lagoon productivity and fish stocks investigation project. Food and Agriculture Organization, Rome, FI/UNDP/IRA/88/001 Field Document 1. En; en., 14 pp.
Holčík, J. and Razavi, B. A. 1992. On some new or little known freshwater fishes from the Iranian coast of the Caspian Sea. Folia Zoologica, Brno, 41(3):271-280.
Holčík, J. and Skořepa, V. 1971. Revision of the roach *Rutilus rutilus* (Linnaeus, 1758), with regard to its subspecies. Annotationes Zoologicae et Botanicae, Bratislava, 64:1-60.
Hollis, G. E. 1978. The falling levels of the Caspian and Aral seas. Geographical Journal, 144:62-80.
Holloway, C. W. 1976. Conservation of threatened vertebrates and plant communities in the Middle East and South West Asia. In: Proceedings of an International Meeting on ecological guidelines for the use of natural resources in the Middle East and South West Asia held at Persepolis, Iran 24-30 May 1975. International Union for the Conservation of Nature and Natural Resources Publications, new series, 34:179-188.
Holly, M. 1929a. Drei neue Fischformen aus Persien. Anzeiger der Oesterreichischen Akademie der Wissenschaften Mathematisch-Naturwissenschaftliche Klasse, Wien, 66(7):62-64.
Holly, M. 1929b. Beiträge zur Kenntnis der Fischfauna Persiens. Zoologischer Anzeiger, 85:183-

185.
Holmes, W. R. 1845. Sketches on the Shores of the Caspian, descriptive and pictorial. Richard Bentley, London. xii + 412 pp.
Homami, M., Mirbagheri, S. A., Borghei, S. M., Abbaspour, M. and Mohammadi Fazel, A. 2017. Evaluation and estimation of changes in water quality using a zoning map and researcher-developed software (Case study: Pir-Bazar River). Environmental Sciences, 15(3):153-172. In Farsi.
Homayoonnezhad, I., Amirian, P. and Piri, I. 2008. Investigation on water quality of Zabol Chahnimeh reservoirs, the effective means for development of water management of Sistan and Baloochestan Province, Iran. World Applied Sciences Journal, 5(3):378-382.
Homayoun Nezhad, I., Savari, A., Saeidpour, B. and Nouri, Gh. R. 2007. Investigation of water quality: a case study of Zabol, Chah-Nimeh reservoirs. Journal of Environmental Science and Technology, 9(3)(34):13-21.
Homayouni, M., Imanpour, M. and Safari, R. 2020. Effect of using dietary administration of betaine and natuzyme multi-enzyme on blood biochemical indices in common carp (*Cyprinus carpio*). Journal of Animal Environment, 12(3):315-322. In Farsi.
Honarpajouh, K. 2003. Study and identification of OP pesticides residues (azinphosmethyl and diazinon) in the Mahabad and Siminerood rivers. M.Sc. Thesis, Tehran University of Medical Science. 95 pp.
Honari, M. 1979. Qanat and human ecosystems in Iran with case studies in a city, Ardakan, and . a town Xur (Khoor). Ph.D. Thesis, University of Edinburgh. xv + 308 pp.
Hora, S. L. 1921. Indian cyprinoid fishes belonging to the genus *Garra*, with notes on related species from other countries. Records of the Indian Museum, 22(5):633-687, pl. XXIV-XXVI.
Hora, S. L. 1923. Fish of the Salt Range, Punjab. In: The fauna of the Salt Range, Punjab. Records of the Indian Museum, 25(4):377-386, pl. 8.
Hora, S. L. 1933. Fish of Afghanistan. Journal of the Bombay Natural History Society, 36(3):688-706.
Hora, S. L. 1935. On a collection of fish from Afghanistan. Journal of the Bombay Natural History Society, 37(4):784-802.
Hora, S. L. 1936. On a further collection of fish from the Naga Hills. Records of the Indian Museum, 38(3):317-331.
Hora, S. L. 1937. Geographical distribution of Indian freshwater fishes and its bearing on the probable land connections between India and the adjacent countries. Current Science, Bangalore, 5(7):351-356.
Hora, S. L. 1956. Fish paintings of the third millennium B.C. from Nal (Baluchistan) and their zoogeographical significance. Memoirs of the Indian Museum, 14(2):73-86, pls. IV-VI.
Hora, S. L. and Misra, K. S. 1943. On a small collection of fish from Iraq. Journal of the Asiatic Society of Bengal, Science, 9(1):1-15.
Hormozi, H. A., Borna, R. and Zohorian Pordel, M. 2019. Investigating the trend of precipitation changes in Khuzestan province and its impact on Shadegan wetland. Journal of Wetland Ecobiology, 11(3):103-117. In Farsi.
Horváth, L., G. Tamás and A.G. Coche, 1985a. Common carp. Part. 1. Mass production of eggs and early fry., FAO Training Series 8, Food and Agriculture Organization of the United Nations, Rome. 87 pp. Translated into Farsi by A. S. Mohagheghi and M. Hedayatifard, Islamic Azad University, Ghaemshahr, 2010.

Horváth, L., G. Tamás and A.G. Coche, 1985b. Common carp. Part. 2. Mass production of advanced fry and fingerlings in ponds. FAO Training Series 9, Food and Agriculture Organization of the United Nations, Rome. 85 pp. Translated into Farsi by A. S. Mohagheghi and M. Hedayatifard, Islamic Azad University, Ghaemshahr, 2010.

Hoseini, H., Nejatkhah Manavi, P. and Fazli, H. 2010. Age and growth parameters of *Rutilus frisii kutum* (Kamenskii, 1901) in the Caspian Sea (Mazandaran Province). Journal of Animal Environment, 2(3)(7):17-24. In Farsi.

Hoseini, H., Tahami, M. S. and Askari Hesni, M. 2015. Bioaccumulation of lead and cadmium in liver and muscle tissues of kutum fish (Teleostei: Cyprinidae) in the southern Caspian Sea. Iranian Journal of Ichthyology, 2(3):165-171.

Hoseini, M., Alishahi, M. and Javadzadeh, N. 2015. Comparison of toxicity of four organophosphorous: trichlorophon, diazinon, malathion and chlorpyrifos in *Barbus grypus*. New Technologies in Aquaculture Development (Journal of Fisheries), 9(1):55-64. In Farsi.

Hoseini, M., Baboli, M. J. and Sary, A. A. 2013. Chemical composition and fatty acids of farmed big head carp (*Hypophthalmichthys nobilis*) and grass carp (*Ctenopharyngodon idella*) filet. AACL Bioflux, 6(3):202-210.

Hoseini, M., Rajabiesterabadi, H., Khalili, M., Yousefi, M., Hoseinifar, S. H. and Van Doan, H. 2020. Antioxidant and immune responses of common carp (*Cyprinus carpio*) anesthetized by cineole: Effects of anesthetic concentration. Aquaculture, 520:734680.

Hoseini, S. M. 2017. Sub-lethal effect of pesticide danitol on erythrocyte antioxidant enzymes activity of common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 5(4):43-54. In Farsi.

Hoseini, S. M. and Ghelichpour, M. 2013a. Effects of pre-sampling fasting on serum characteristics of common carp (*Cyprinus carpio* L.). International Journal of Aquatic Biology, 1(1):6-13.

Hoseini, S. M. and Ghelichpour, M. 2013b. The effect of different doses of eugenol and induction time on the blood cortisol and glucose level in goldfish (*Carassius auratus*). Journal of Applied Ichthyological Research, 1(1):29-40, 3. In Farsi.

Hoseini, S. M. and Nodeh, A. J. 2012. Toxicity of copper and mercury to Caspian roach *Rutilus rutilus caspicus*. Journal of the Persian Gulf (Marine Science), 3(9):9-14.

Hoseini, S. M. and Nodeh, A. J. 2013. Susceptibility of Caspian roach (*Rutilus rutilus caspicus*) fingerlings to formalin. Journal of Applied Aquaculture, 25(3):191-197.

Hoseini, S. M., Nodeh, A. J. and Hosseini, S. A. 2013. Formalin toxicity to Caspian roach, *Rutilus rutilus caspicus* fry. Ecopersia, 1(2):199-206.

Hoseini, S. M., Taheri Mirghaed, A., Iri, Y., Hosseinifar, S. H., Van Doan, H. and Reverter, M. 2021. Effects of dietary Russian olive, *Elaeagnus angustifolia*, leaf extract on growth, hematological, immunological, and antioxidant parameters in common carp, *Cyprinus carpio*. Aquaculture, 536:736461.

Hoseini, S. M. and Tarkhani, R. 2013. Serum biochemical characteristics of *Carassius auratus* (L) following short-term formalin or NaCl treatment. International Journal of Aquatic Biology, 1(1):14-21.

Hoseini, S. M., Vatnikov, Y. A., Kulikov, E. V., Petrov, A. K., Hoseinifar, S. H. and Van Doan, H. 2019. Effects of dietary arginine supplementation on ureagenesis and amino acid metabolism in common carp (*Cyprinus carpio*) exposed to ambient ammonia. Aquaculture, 511:734209.

Hoseini, S. M., Yousefi, M., Hoseinifar, S. M. and Van Doan, H. 2019a. Effects of dietary arginine supplementation on growth, biochemical, and immunological responses of common carp (Cyprinus carpio L.), stressed by stocking density. Aquaculture, 503:452-459.

Hoseini, S. M., Yousefi, M., Hoseinifar, S. M. and Van Doan, H. 2019b. Cytokines' gene expression, humoral immune and biochemical responses of common carp (*Cyprinus carpio*, Linnaeus, 1758) to transportation density and recovery in brackish water. Aquaculture, 504:13-21.

Hoseini, S. M., Yousefi, M., Hoseinifar, S. M. and Van Doan, H. 2019c. Antioxidant, enzymatic and hematological responses of common carp (*Cyprinus carpio*) fed with myrcene- or menthol-supplemented diets and exposed to ambient ammonia. Aquaculture, 506:246-255.

Hoseini, Y. 2019. Study the self purification capacity and water quality of Qarahsoo River using Qual2kw and NSFWQI Models. Journal of Wetland Ecobiology, 11(3):41-60. In Farsi.

Hoseinie, S. E. 1995. Artificial propagation of (*Aspius aspius*) (*sic*). Iranian Scientific Fisheries Journal, 3(4):23-31, 4. In Farsi.

Hoseinifar, S. H. 2016. Comparative study of efficiency of prebiotic with different degree of polymerization on intestinal microbiota of carp (*Cyprinus carpio*) larvae. Journal of Aquaculture Sciences, 4(1):39-47. In Farsi.

Hoseinifar, S. H., Hosseini, M., Paknejad, H., Safari, R., Jafar, A., Yousefi, M., Van Doan, H. and Mozanzadeh, M. T. 2019. Enhanced mucosal immune responses, immune related genes and growth performance in common carp (*Cyprinus carpio*) juveniles fed dietary *Pediococcus acidilactici* MA18/5M and raffinose. Developmental and Comparative Immunology, 94(4):59-65.

Hoseinifar, S. H., Jahazi, M. A., Mohseni, R., Yousefi, M., Bayani, M., Mazandarani, M., Van Doan, H. and El-Haroun, E. R. 2021. Dietary apple peel derived pectin improved growth performance, antioxidant enzymes and immune response in common carp, *Cyprinus carpio* (Linnaeus, 1758) (*sic*). Aquaculture, 535:736311.

Hoseinifar, S. H., Khalili, M., Khoshbavar Rostami, H. and Estaban, M. Á. 2013. Dietary galactooligosaccharide affects intestinal microbiota, stress resistance, and performance of Caspian roach (*Rutilus rutilus*) fry. Fish and Shellfish Immunology, 35(5):1416-1420.

Hoseinifar, S. H., Khalili, M., Rufchaei, R., Raeisi, M., Attar, M., Cordero, H. and Esteban, M. Á. 2015. Effects of date palm fruit extracts on skin mucosal immunity, immune related genes expression and growth performance of common carp (*Cyprinus carpio*) fry. Fish and Shellfish Immunology, 47(2):706-711.

Hoseinifar, S. H., Khodadadian Zou, H., Kolangi Miandare, H., Van Doan, H., Romano, N. and Dadar, M. 2017. Enrichment of common carp (*Cyprinus carpio*) diet with medlar (*Mespilus germanica*) leaf extract: Effects on skin mucosal immunity and growth performance. Fish and Shellfish Immunology, 67:346-352.

Hoseinifar, S. H., Khodadadian Zou, H., Paknejad, H., Hajimoradloo, A. and Van Doan, H. 2019. Effects of dietary white-button mushroom powder on mucosal immunity, antioxidant defence, and growth of common carp (*Cyprinus carpio*). Aquaculture, 501:448-454.

Hoseinifar, S. H., Khodadadian Zou, H., Van Doan, H., Harikrishnan, R., Yousefi, M., Paknejad, H. and Ahmadifar, E. 2019. Can dietary jujube (*Ziziphus jujuba* Mill.) fruit extract alter cutaneous mucosal immunity, immune related genes expression in skin and

growth performance of common carp (*Cyprinus carpio*)? Fish and Shellfish Immunology, 94:705-710.

Hoseinifar, S. H., Rufchaie, R. and Moghadam, D. P. 2015. The influence of *Pontogammarus maeoticus* extract on immune response and growth performance of Caspian roach *Rutilus rutilus* fry. Middle East Aquaculture Forum, Dubai International Convention and Exhibition Center, Dubai, United Arab Emirates, 5-6 April 2015 (abstract).

Hoseinifar, S. H., Sharifian, M., Vesaghi, M. J., Khalili, M. and Estaban, M. Á. 2014. The effects of dietary xylooligosaccharide on mucosal parameters, intestinal microbiota and morphology and growth performance of Caspian white fish (*Rutilus frisii kutum*) fry. Fish and Shelllfish Immunology, 39(2):213-236.

Hoseinifar, S. H., Sohrabi, A., Paknejad, H., Jafari, V., Paolucci, M. and Van Doan, H. 2018. Enrichment of common carp (*Cyprinus carpio*) fingerlings diet with *Psidium guajava*: The effects on cutaneous mucosal and serum immune parameters and immune related genes expression. Fish and Shellfish Immunology, 86:688-694.

Hoseinifar, S. H., Soleimani, N. and Ringo, E. 2014. Effects of dietary fructo-oligosaccharide supplementation on the growth performance, haemato-immunological parameters, gut microbiota and stress resistance of common carp (*Cyprinus carpio*) fry. British Journal of Nutrition, 112(8):1296-1302.

Hoseinifar, S. H., Zoheiri, F. and Caipang, C. M. 2016. Dietary sodium propionate improved performance, mucosal and humoral immune responses in Caspian white fish (*Rutilus frisii kutum*) fry. Fish and Shellfish Immunology, 55:523-528.

Hoseinifar, S. H., Zoheiri, F., Dadar, M., Rufchaei, R. and Ringø, E. 2016. Dietary galactooligosaccharide elicits positive effects on non-specific immune parameters and growth performance in Caspian white fish (*Rutilus frisii kutum*) fry. Fish and Shellfish Immunology, 56:467-472.

Hoseinifar, S. H., Zoheiri, F. and Lazado, C. C. 2016. Dietary phytoimmunostimulant Persian hogweed (*Heracleum persicum*) has more remarkable impacts on skin mucus than on serum in common carp (*Cyprinus carpio*). Fish and Shellfish Immunology, 59:77-82.

Hoseinpour, H., Bahrami Kamangar, B., Zadmajid, V. and Ghaderi, E. 2019. Effect of urban wastewater on age and growth of chub *Squalius cephalus* (Linnaeus, 1758) in the Gheshlagh River, Sanandaj. Journal of Applied Ichthyological Research, 7(3):1-16. In Farsi.

Hoseinzadeh, M., Khara, H., Yousefian, M., Saeidi, A. A., Mirrasouli, E. and Besmel, A. R. 2010. A survey of parasites of silver carp (*Hypophthalmichthys molitrix*) in some of Fereydunkenar reservoirs. Journal of Biology Science, 3(4)(11):31-38. In Farsi.

Hoseinzadeh, M. A., Gorjian Arabi, M. H., Shapory, M. and Owfi, F. 2013. Habitat mapping of Mazandaran coast, from Bablsar (*sic*) until Amir Abad's Behshahr's Port (South Caspian Sea). World Journal of Fish and Marine Sciences, 5(4):362-366.

Hoseinzadeh, M. A., Owfi, F., Gorjian Arabi, M. H. and Keshavarz, M. 2016. Ecological classification of southern zones of the Caspian Sea (Mazandaran Province), based on CMECS model. Iranian Journal of Fisheries Sciences, 15(3):1246-1253.

Hoseinzadeh, S. and Bahrekazemi, M. 2019. Effect of orally administration of lactoferrin, β-glucan and *Nigella sativa* on the growth indexes (*sic*) and hematological and immunological parameters in common carp *Cyprinus carpio*. Journal of Animal Environment, 11(2):187-196. In Farsi.

Hoseinzadeh Sahafi, H. 2011. Rearing of Indian carps fries to 1g weight in earthen ponds.

Iranian Fisheries Science Research Institute, Tehran. 48 pp. In Farsi.
Hoseinzadeh Sahafi, H. 2012. Feasibility study on Indian carps aquaculture in I.R.IRAN. Iranian Fisheries Science Research Institute, Tehran. 113 pp. In Farsi.
Hoseinzadeh Sahafi, H., Dehgan Madiseh, S., Hamidinejad, M., Mortezavizadeh, A. and Velayatzadeh, M. 2014. The survey of water quality of (*Labeo rohita*) fish ponds in Khozestan Province. Journal of Aquatic Animals and Fisheries, 4(16):25-32. In Farsi.
Hoseinzadeh Sahafi, H., Talebzadeh, S. A. and Naji, T. 2018. The role of different concentration of *Vitex agnus-castus* on control of gonad of *Carassius auratus*. Journal of Aquaculture Development, 12(3):63-74. In Farsi.
Hosennezhad Jadidi, M., Khoshkholgh, M. and Alaf Noveyrian, H. 2020. Effect of different levels of *Aloe vera* powder on growth performance and hematological indices of goldfish (*Carassius auratus*). Journal of Aquaculture Development, 13(4):37-52. In Farsi.
Hoseyni, S. J., Ziaei-nejad, S., Johari, S. A. and Nematdoost Haghi, B. 2017. Effects of nanosized titanium dioxide on gill histopathological changes in common carp (*Cyprinus carpio*) exposed to oil water-soluble phase. Journal of Aquaculture Development, 11(3):13-27. In Farsi.
Hoshyar, F., Rezaei, H. R., Seyfali, M. and Rezaei, S. 2017. Phylogenetic and genetic diversity of spirlin fish (*Alburnoides eichwaldi*) based on cytochrome b sequencing in five rivers of the northern areas in Iran. Journal of Animal Environment, 9(3):291-304. In Farsi.
Hossaini, A., Filizadeh, Y. and Nezami, Sh. A. 2011. Preference and growth rate of grass carp (*Ctenopharyngodon idella* Val.) on 6 aquatic plants. Renewable Natural Resources Research, 2(2):86-99. In Farsi.
Hossein, F., Ouraji, H., Fereidouni, A. E. and Molla, A. E. 2011. Comparison of *Artemia urmiana* nauplii with biomar feed in rearing *Rutilus frisii kutum* larvae. World Journal of Fish and Marine Sciences, 3(5):393-395.
Hosseini, A., Chaharlang, F., Sotoudeh, E., Alishahi, M. and Modaresi, M. 2016. The effect of isolated *Lactobacillus* from gut of *Barbus grypus* on growth performance, survival and gut microflora of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 25(3):167-179. In Farsi.
Hosseini, A., Mousavi, Z., Sotoudeh, E., Mohammadi, M. and Abbaszadeh, A. 2016. Macroscopic and microscopic studies of reproductive cycle of *Capoeta capoeta intermedia* in Shapour River, Bushehr province. Journal of Animal Environment, 8(3):123-132. In Farsi.
Hosseini, A. and Sotoudeh, E. 2016. Reproductive biology of *Capoeta capoeta intermedia* (Cyprinidae, Teleostei) in Shapour River (Bushehr province), Iran. Journal of Animal Researches (Iranian Journal of Biology), 30(1):51-59. In Farsi.
Hosseini, H., Ghelichi, A., Akrami, R. and Jorjani, S. 2014. Effect of L-lysine on growth, body composition and survival in juvenile common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 8(1):35-43. In Farsi.
Hosseini, H., Safaeian, Sh. and Sadeghi, H. 2009. Bacteriological and chemical TVB-N in (*Rutilus frisii kutum*) changes in temperature 4°C and -18°C. Journal of Marine Science and Technology Research, 4(1):37-46. In Farsi.
Hosseini, M., Adeli, A. and Vahedi, M. 2016. Investigating fish purchase patterns and preferences among the consumers of Sari. Iranian Scientific Fisheries Journal, 25(3):103-112. In Farsi.
Hosseini, M., Kolangi Miandare, H., Hoseinifar, S. H. and Yarahmadi, P. 2016. Dietary

Lactobacillus acidophilus modulated skin mucus protein profile, immune and appetite gene expression in gold fish (*Carassius auratus gibelio*). Fish and Shellfish Immunology, 59:149-154.

Hosseini, M., Kolangi Miandare, H., Shabani, A., Hoseinifar, S. H. and Yarahmadi, P. 2017. Corrigendum to “Dietary *Lactobacillus acidophilus* modulated skin mucus protein profile, immune and appetite gene expression in gold fish (*Carassius auratus gibelio*)” [Fish Shellfish Immunol. 59C (2016) 149e154]. Fish and Shellfish Immunology, 71:443.

Hosseini, S. A. and Hoseini, S. M. 2012. Effect of acute crowding stress on subsequent osmotic challenge and recovery in juvenile common carp (*Cyprinus carpio*). Comparative Clinical Pathology, 21(5):583-588.

Hosseini, S. A. and Hoseini, S. M. 2013. Effect of dietary tryptophan on stress response of wild common carp *Cyprinus carpio* L. World Journal of Fish and Marine Sciences, 5(1):49-55.

Hosseini, S. A., Mirvaghefi, A., Alishahi, M. and Rastiannasab, A. 2014. Measurement some of immunological parameters *Cyprinus carpio* in the polluted (Ahwaz) and non-polluted (Shoushtar) area in Karun river in Iran. Journal of Applied Biological Sciences, 8(2):81-85.

Hosseini, S. A. H., Mirvaghefi, A. R., Zare, P. and Nasiri, E. 2011. Investigation of infection by plerocercoid stage of *Ligula intestinalis* in amorcheh gastric “Pseudorasbora parva”, in Zabol Chahnimeh reservoirs. Journal of Fisheries, 5(2)(18):141-148. In Farsi.

Hosseini, S. H. 1987. The study of infection of fish with *Clinostomum* sp. in the lake south of Tehran. Ph.D. Thesis, Department of Veterinary Medicine, University of Tehran. 190 pp. In Farsi.

Hosseini, S. M. and Adeli, A. 2017. Prioritizing the effective factors on the behavior of fish consumers (case study: Sari city). Journal of Fisheries Science and Technology, 5(4):99-110. In Farsi.

Hosseini, S. M., Adeli, A. and Vahedi, M. 2016. Evaluating barriers and barriers affecting on per capita fish consumption in Sari. Journal of Fisheries (Iranian Journal of Natural Resources), 69(3):341-350. In Farsi.

Hosseini, S. M. and Hoseinie, S. A. 2013. Correlation between stress indicators with anesthesia time and stage in common carp, *Cyprinus carpio* under different clove solution concentrations. Journal of Utilization and Cultivation of Aquatics, 1(4):57-67. In Farsi.

Hosseini, S. M., Hoseinifar, S. H., Mazandarani, M., Paknejad, H., Van Doan, H. and El-Haroun, E. 2020. The potential benefits of orange peels derived pectin on serum and skin mucus immune parameters, antioxidant defence and growth performance in common carp (*Cyprinus carpio*). Fish and Shellfish Immunology, 103:17-22.

Hosseini, S. M., Kariminasab, M., Batebi-Navaei, M., Aflaki, F., Monsefrad, F., Regenstein, J. M. and Vajdi, R. 2015. Assessment of the essential elements and heavy metals content of the muscle of kutum (*Rutilus frisii kutum*) from the south Caspian Sea and potential risk assessment. Iranian Journal of Fisheries Sciences, 14(3):660-671.

Hosseini, S. M., Shabany, A., Kolangi Miandare, H. and Safari, R. 2016. Genetic structure of *Alburnoides eichwaldii* (De Filippi, 1863) in Gilan (Roodsar, Polrud River) using microsatellite markers. Journal of Applied Ichthyological Research, 3(4):49-60. In Farsi.

Hosseini, S. S., Jeiran, A., Mahin, M. and Aghili, S. M. 2012. Ichthyological study of Caspian vimba (*Vimba vimba persa* Pallas, 1811) in Anzali Lagoon. Journal of Aquatic Animals and Fisheries, 3(9):21-29. In Farsi.

Hosseini, S. V. 2014. Evaluation of biogenic amines as quality indicator of common carp (*Cyprinus carpio*) during ice storage. Journal of Fisheries Science and Technology, 2(4):11-21. In Farsi.

Hosseini, S. V. and Kalbassi, M. R. 2005. Karyotype analysis in *Schizothorax zarudnyi* from Hamoon Lake. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', September 8-10, Shahr-e Kord, Iran (abstract).

Hosseini, S. V., Rezaei, M., Sahari, M. A. and Hosseini, H. 2005. Lipid quality changes of kutum (*Rutilus frisii kutum*) during ice storage. Iranian Journal of Food Science and Technology, 2(2):39-49. In Farsi.

Hosseini Alhashemi, A., Karbassi, A., Hassanzadeh Kiabi, B., Masoud Monavari, S. and Sadegh Sekhavatjou, M. 2012. Bioaccumulation of trace elements in different tissues of three commonly available fish species regarding their gender, gonadosomatic index, and condition factor in a wetland ecosystem. Environmental Monitoring and Assessment, 184(4):1865-1878.

Hosseini Alhashemi, A., Sekhavatjou, M. S., Hassanzadeh Kiabi, B. and Karbassi, A. R. 2012. Bioaccumulation of trace elements in water, sediment, and six fish species from a freshwater wetland, Iran. Microchemical Journal, 104:1-6.

Hosseini Fard, S. M., Rahmani, J. and Ranjbar Yaneh Sari, M. 2017. Investigation of parasitic fauna of *Squalius turcica* (*sic*) in Chalus River. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 158-162. In Farsi.

Hosseini Fard, S. M., Talebi, S. A. and Alaedini Shourmasti, A. 2017. Investigation of the amount of parasitic fauna of waterlogged fish in Langour in Babol. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 817-821. In Farsi.

Hosseini Kenari, S. M., Aalam, M., Ashja, A. A. and Behnaz, M. 2010. Study on biology of reproduction in *Vimba vimba* (L. 1758) in Kiashahr region. Journal of Fisheries, 4(3)(15):47-60. In Farsi.

Hosseini Kenari, S. M., Alam, M. and Seif Reihani, M. 2011. Study on age and some other morphologic factors of *Vimba vimba* (L. 1758) broodstocks in Kiashahr region of Guilan Province. Journal of Fisheries, 5(2):81-92. In Farsi.

Hosseini Mashhadi, S. H., Hedaiatifard, M. and Ghobadi, S. 2017. The effect of different levels of ascorbic acid on the growth performance and survival of fingerling common carp *Cyprinus carpio.* Iranian Scientific Fisheries Journal, 26(1):1-14. In Farsi.

Hosseini Shekarabi, S. P., Seyedalikhani, S. B., Shamsaie Mehrgan, M., Seyedalhosseini, S. H. and Manouchehri, H. 2019. Effect of different levels of organic acids mixture on some growth parameters and carcass composition of common carp (*Cyprinus carpio*) juveniles. Iranian Scientific Fisheries Journal, 28(4):35-43. In Farsi.

Hosseinibehbahani, F., Nazari Khorasgani, Z. and Behtash, N. 2012. Organochlorine pesticide residue in Astara River at Gilan Province, Iran. Toxicology Letters, 211(Supplement):S90.

Hosseinie, S. M., Mirghaffari, N., Mahboobi Soofiani, N. and Hosseini, S. V. 2011. Risk assessment of mercury due to consumption of kutum of the Caspian Sea (*Rutilus frisii kutum*) in Mazandaran Province. Journal of Fisheries (Iranian Journal of Natural Resources), 64(3):243-257. In Farsi.

Hosseinie, S. V. and Kalbasi, M. R. 2003. Karyological study on snow trout, *Schizothorax*

zarudnyi, in Zahak of Sistan-Balochestan Province - Iran. Iranian Journal of Marine Sciences, 2(1):13-22. In Farsi.

Hosseinifar, S. H., Hosseini, M., Paknezhad, H., Safari, R. and Jafer, A. 2018. The effect of retene and *Lactobacillus acidophilus* on non specific immune related gene expression in carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 7(1):35-41. In Farsi.

Hosseinifard, S. M., Pichkah, F. and Asgharzade Komachali, Z. 2017. Survay (*sic*) of parasitic fauna in *Capoete* (*sic*) *capoeta*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 185-189. In Farsi.

Hosseinifard, S. M., Youssefi, M. R. and Yaghobi, A. 2014. Evaluation of fish parasite fauna in Garmrood River in Amol, summer 2011. Breeding and Aquaculture Sciences Quarterly, 1(1):17-22. In Farsi.

Hosseini-Zare, N., Gholami, A., Panahpour, E. and Jafarnejadi, A. 2014. Pollution load assessment in the soil and water resources: A case study in Karun River drainage basin, southwest of Iran. European Online Journal of Natural and Social Sciences, 3(3, Special Issue on Environmental, Agricultural, and Energy Science):427-434.

Hosseinjani, A., Babaei, H., Esmaeil Sadeghinejad, M. and Sayad Bourani, M. 2019. The small-scale aquaculture in the rural water reservoir (A case study in Zanjan province-Ijruod (*sic*) city). Journal of Aquaculture Development, 13(2):51-64. In Farsi.

Hosseinjani, A., Sayyad Bourani, M., Valipour, A. and Ahmadnezhad, M. 2020. A review of the status and development requirements for cage aquaculture in Iran and the world. Journal of Aquaculture Development, 14(1):25-37. In Farsi.

Hosseinnia, Z., Shabani, A. and Kolangi Miandare, H. 2016. Genetic diversity of *Abramis brama* (Berg, 1905) (*sic*) in Chamkkale and Bandar Anzali coast using microsatellite markers. Journal of Animal Environment, 8(2):119-124. In Farsi.

Hosseinnia, Z., Shabany, A. and Kolangi-Miandare, H. 2014. Comparison of genetic variation of wild and farmed bream (*Abramis brama orientalis; berg, 1905*) (*sic*) using microsatellite markers. Molecular Biology Research Communications, 3(3):187-195.

Hosseinpour, E., Mahdizadeh, S., Staji, H., Akbarein, H. and Norouzi, P. 2018. Survey on mycobacteriosis on goldfish and guppy species in Semnan, using PCR assay. Iranian Scientific Fisheries Journal, 27(2):173-178. In Farsi.

Hosseinpour, N. 1995. Survey on macro-zoobenthic resources in Siahdarvishan and Pasikhan Rivers, Potamon Zone (Quantitative). Iranian Scientific Fisheries Journal, 4(3):8-21, 3. In Farsi.

Hosseinpour, N., Peyghan, R. and Mohamadian, B. 2010. Study on the parasitic infection and lesions of gills in grass carp (*Ctenopharyngodon idella*) in Azadegan fish farming site - Ahvaz. Journal of Marine Biology, 2(1):47-55. In Farsi.

Hosseinpour, S., Gholamhosseini, A. and Nayebzadeh, H. 2018. An investigation on fish helminth infections in Seymareh River in Lorestan Province, Iran. Iranian Journal of Veterinary Medicine, Supplementary Issue, 12(5):17.

Hosseinzade, M., Mojazi Amiri, B., Iri, Y. and Poorbagher, H. 2021. Effects of diazinon on olfactory epithelium and genes related to olfactory signal transduction in Caspian roach, *Rutilus caspicus*. Caspian Journal of Environmental Sciences, 19(2):211-218.

Hosseinzadeh, H. 2000. Status of aquaculture in Iran: Past, present, future. The Third World Fisheries Congress, Beijing, 31 Oct - 2 Nov 2000 (title).

Hosseinzadeh, H. 2003. Status of aquaculture in Iran: Past, present, future. American Fisheries

Society Symposium, 38:9-17.
Hosseinzadeh, H., Amaninejad, P. and Soltani, M. 2017. Effects of 4-nonylphenol on hepatosomatic, gonadosomatic indicators, and change plasma IgM immunoglobulin and lysozyme activity in koi carp (*Cyprinus carpio carpio*). Journal of Aquaculture Development, 11(4):29-44. In Farsi.
Hosseinzadeh, H., Amaninejad, P. and Soltani, M. 2018. Effects of 4-nonylphenol on production of plasma vitellogenine and changes steroid hormones in koi carp (*Cyprinus carpio carpio*). Journal of Animal Environment, 9(3):185-194. In Farsi.
Hosseinzadeh, M. and Tukmechi, A. 2016. Isolation and identification of enterotoxin producing *Aeromonas hydrophila* from common carp (*Cyprinus carpio*). Journal of Animal Environment, 7(4):173-178. In Farsi.
Hosseinzadeh Sahafi, H. 2009. Imprinting of white fish (*Rutilus frisii kutum*) with morpholine. Iranian Fisheries Science Research Institute, Tehran. 80 pp. In Farsi.
Hosseinzadeh Sahafi, H. 2013. Morpholine imprinting and homing behavior of kutum (*Rutilus firisi* (*sic*) *kutum*) in the Caspian Sea. Journal of the Persian Gulf (Marine Science), 4(11):47-54.
Hosseinzadeh Sahafi, H. 2015. Optimum management of warmwater fish farms stocking, capacity determination, growth rate and brood stock managements and harvesting. Iranian Fisheries Science Research Institute, Tehran. 45 pp. In Farsi.
Hosseinzadeh Sahafi, H. 2016. The survey on imported F1 generation carp species in order to enhance genetic diversity of Chinese basic domesticated carp species in Iran. Iranian Fisheries Science Research Institute, Tehran. 70 pp. In Farsi.
Hosseinzadeh Sahafi, H., Abdolhai, H., Toloee, M. H. and Sayadfar, J. 2012. Comparison of morpholin imprinting in different fry stages of kutum (*Rutilus frisii kutum*). Journal of Marine Sciences and Technology, 10(3):14-22. In Farsi.
Hosseinzadeh Sahafi, H., Amaninejad, P. and Soltani, M. 2017. Effects of 4-phenol on hepatosomatic, gonadosomatic indicators, and changes in plasma IgM immunoglobulin and lysozyme activity in koi carp (*Cyprinus carpio carpio*). Journal of Aquaculture Development, 11(4):29-44. In Farsi.
Hosseinzadeh Sahafi H., Dehghan Madiseh, S., Koohilai, S., Hamidinejad, M. and Velayatzadeh, M. 2020. Plasma levels of sex steroids (testosterone, progesterone and 17β-estradiol) in rohu carp *Labeo rohita* broodstock from Khuzestan, Iran, Iranian Journal of Fisheries Sciences, 19(6):3063-3074.
Hosseinzadeh Sahafi H., Khadem Sadr, Sh. And Yelghi, S. 2014. Growth indices of Indian major carp (*Crirhinus* (*sic*) *cirrhosus*) from fry to fingerling stage in the earthen ponds in Gilan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 8(3):65-75. In Farsi.
Hosseinzadeh Sehafi, H., Khodadadi, M. and Ayati Behbahani, S. 2014. Seasonal fluctuation of sex steroid hormones in Indian major carp *Catla catla* in Khouzestan, Iran. Journal of Environmental and Analytical Toxicology, 4(5):1-5.
Hou, Z. and Li, S. 2018. Tethyan changes shaped aquatic diversification. Biological Reviews, 93(2):874-896.
Hourcade, B., Mazurek, H., Papoli-Yazdi, M.-H. and Taleghani, M. 1998. Atlas d'Iran. Reclus - La Documentation Française, Montpellier. 192 pp.
Houtum-Schindler, A. 1891. Note on the Kur River in Fârs, its sources and dams, and the districts it irrigates. Proceedings of the Royal Geographical Society, 13(5):287-291.

Howes, G. 1981. Anatomy and phylogeny of the Chinese major carps *Ctenopharyngodon* Steind., (*sic*) 1866 and *Hypophthalmichthys* Blkr., 1860. Bulletin of the British Museum (Natural History) Zoology, 41(1):1-52.

Howes, G. 1982. Anatomy and evolution of the jaws in the semiplotine carps with a review of the genus *Cyprinion* Heckel, 1843 (Teleostei: Cyprinidae). Bulletin of the British Museum (Natural History) Zoology, 42(4):299-335.

Howes, G. 1984. Phyletics and biogeography of the aspinine cyprinid fishes. Bulletin of the British Museum (Natural History) Zoology, 47(5):283-303.

Howes, G. J. 1980. The anatomy, phylogeny and classification of bariliine cyprinid fishes. Bulletin of the British Museum (Natural History) Zoology, 37(3):129-198.

Howes, G. J. 1987. The phylogenetic position of the Yugoslavian cyprinid fish genus *Aulopyge* Heckel, 1841, with an appraisal of the genus *Barbus* Cuvier & Cloquet, 1816 and the subfamily Cyprininae. Bulletin of the British Museum (Natural History), Zoology, 52(5):165-196.

Hsü, K. J. 1978. When the Black Sea was drained. Scientific American, 238(5):52-63.

Huang, S-P., Wang, F-Y. and Wang, T-Y. 2017. Molecular phylogeny of the *Opsariichthys* group (Teleostei: Cypriniformes) based on complete mitochondrial genomes. Zoological Studies, 56:e40.

Hubbs, C. L. and Lagler, K. F. 1958. Fishes of the Great Lakes Region. University of Michigan Press, Ann Arbor. xv + 213 pp.

Huntington, E. 1905a. The Basin of Eastern Persia and Sistan, pp. 217-316. In: Explorations in Turkestan with an account of the Basin of Eastern Persia and Sistan. Carnegie Institution of Washington Publication, 26:324 pp.

Huntington, E. 1905b. The depression of Sistan in eastern Persia. Bulletin of the American Geographical Society, 37(5):271-281.

Huntington, E. 1907. The historic fluctuations of the Caspian Sea. Bulletin of the American Geographical Society, 39(10):577-596.

Huq, M. F., Al-Saadi, H. A. and Hameed, H. A. 1981. Studies on the primary production of the river Shatt Al-Arab at Basrah, Iraq. Hydrobiologia, 77(1):25-29.

Huseynov, S. 2011. Fate of the Caspian Sea. Natural History, 120(1):30-37.

Hussain, N. A. and Ali, T. S. 2006. Trophic nature and feeding relationships among Al Hammer marsh fishes, southern Iraq. Marsh Bulletin, 1(1):9-18.

Hussain, N. A., Ali, T. S. and Saud, K. D. 1989. Seasonal fluctuations and composition of fish assemblage in the Shatt Al-Arab at Basrah, Iraq. Journal of Biological Sciences Research, Baghdad, 20(1):139-150.

Hussain, N. A., Al-Najar, H. H. K., Al-Saad, H. T., Yousif, O. H. and Al-Saboonchi, A. A. 1991. Shatt al-Arab River: Basic scientific studies. Marine Science Centre Publication, Basrah, 10:391 pp. In Arabic.

Hussain, N. A., Mohamed, A-R. M., Al Noor, S. A., Coad, B., Mutlak, F. M., Ibrahem, M., Al-Sudani, I. M., Mojer, A. M., Toman, A. J. and Abdad, M. A. 2006. Species composition, ecological indices, length frequencies and food habits of fish assemblages of the restored southern Iraqi marshes. Report by the University of Basrah, Basrah, Iraq. 114 pp., 12 tables, 59 figures.

Hussain, N. A., Younis, K. H. and Yousif, U. H. 1997. The composition of small fish assemblages in the River Shatt Al-Arab near Basrah (Iraq). Acta Hydrobiologica, 39(1/2):29-37.

Hussain, N. A., Younis, K. H. and Yousif, U. H. 2001. Evaluation of environmental degradation in the fish assemblage of Shatt Al-Arab River. Pakistan Journal of Zoology, 33(2):93-98.

Hussein, S. A. 2000. Interaction between introduced exotics and native ichthyofauna and their impact on aquatic ecosystems, southern Iraq. Basrah Journal of Science, B, 18(2):125-146.

Hussein, S. A., Abed, J. M. and Ahmed, H. A. 2000. Comparative study on growth rates of the bunni *Barbus sharpeyi* Gunther 1874 in five Iraqi localities. Journal of Basrah Researches, 24(1):7-14.

Hussein, S. A., Al-Daham, N. K. and Al-Kanaani, S. M. 1993. Selection of benthic molluscs and macrocrustaceans and their importance in the diet of three sympatric fish species in Garma Marshes, Iraq. Marina Mesopotamica, 6(2)(1991):263-280.

Hussein, S. A., Al-Daham, N. K. and Al-Kanaani, S. M. 2000a. Monthly variations in feeding activities and feeding intensities of three sympatric native cyprinids and an introduced common carp in Al-Hammar lake, southern Iraq. Basrah Journal of Agricultural Science, 13(1):39-48.

Hussein, S. A., Al-Daham, N. K. and Al-Kanaani, S. M. 2000b. Comparative study on ranking index and volumetric methods in calculating diet overlap and competition coefficient of four sympatric cyprinids in Al-Hammar Lake, southern Iraq. Journal of Basrah Researches, 25(1):62-72.

Hussein, S. A., Al-Daham, N. K. and Al-Kanaani, S. M. 2000c. Dietary overlap between the common carp *Cyprinus carpio* L. and three native cyprinids in Al-Hammar lake, southern Iraq. Journal of Basrah Researches, 25(1):73-88.

Hussein, S. A. and Al-Kanaani, S. M. 1989. Feeding ecology of shilig (Aspius vorax Heckel) in Al-Hammar marsh, southern Iraq. I - Diet of small individuals. Basrah Journal of Agricultural Science, 2(1 & 2):81-92.

Hussein, S. A. and Al-Kanaani, S. M. 1991. Feeding ecology of shilig (Aspius vorax Heckel) in Al-Hammar marsh, southern Iraq. II:- Diet of large individuals. Basrah Journal of Agricultural Science, 4(1 & 2):113-122.

Hussein, S. A. and Al-Kanaani, S. M. 1994. Feeding ecology of the shilig Aspius vorax Heckel from Al-Hammar Marsh, southern Iraq. III. Seasonal pattern of feeding. Marina Mesopotamia, 8(1)(1993):91-103.

Hutchinson, G. E. and Cowgill, U. M. 1963. Chemical examination of a core from Lake Zeribar, Iran. Science, 140(3562):67-69.

Hydrorybproject. 1965. Fish-cultural reclamation of the Pahlavi (Mordab) Bay. State Industrial Fisheries Committee, U.S.S.R., State Design Institute on Hydrotechnical, Fish-Cultural Reclamation and Land Construction, Moscow. MS, 60 pp.

I

Ibarra, M. and Stewart, D. J. 1987. Catalogue of type specimens of recent fishes in Field Museum of Natural History. Fieldiana Zoology, 35:iii + 112 pp.

Ibrahimzadeh, I. 1995. Hamoon Lake and its vital role. Water and the Environment, Tehran, 12 & 13:47-52. In Farsi.

Iezadi, Gh. 2000. Preliminary step of study on *Barbus* species in Fars Province. First National Symposium on *Barbus* fishes of Iran, Ahvaz, January, 10-11 (abstract).

Ilhan, A., Balık, S., Sarı, H. M. and Ustaoğlu, M. R. 2005. Batı ve Orta Anadolu, Güney

Marmara, Trakya ve Batı Karadeniz Bölgeleri Içsularındaki *Carassius* (Cyprinidae, Pisces) Türleri ve Dagılımları [Species and distributions of *Carassius* (Cyprinidae, Pisces) in inland waters of western and central Anatolia, southern Marmara, Thrace and western Black Sea regions]. Ege Üniversitesi Su Ürünleri Dergisi, 22(3-4):343-346.

Iljin, B. S. 1927. Rybolovstvo v vodakh severnoi Persii, sdavaemykh v arendu mestnomu naseleniyu (iz rabot Kaspiiskoi Ekspeditsii 1914-1915 g) [Fisheries in the waters of northern Persia, leased to the local tenant population (from the work of the Caspian Expedition 1914-1915)]. Izvestiya Otdela Prikladnoi Ikhtiologii, Leningrad, 7(1):101-134.

Imami, S. M. H. 2000. Lar National Park, a beautiful and unique region in Iran. Hunting and Nature Lovers, Tehran, 2:4-7. In Farsi (English at www.netiran.com/Htdocs/Clippings/Social/200917XXSO02.html, downloaded 15 December 2000).

Imandel, K., Razeghi, N. and Samar, P. 1978. Tehran ground water pollution by detergents. Water, Air, and Soil Pollution, 9(1):119-122.

Imanpoor, M. R., Ahmadi, A. R. and Kabi, M. 2011. Effects of sub lethal concentration of chloramin T on growth, survival, haematocrit and some blood biochemical parameters in common carp fry (*Cyprinus carpio*). AACL Bioflux, 4(3):280-291.

Imanpoor, M. R. and Bagheri, T. 2010. The correlation between blood biochemical factors of coelomic fluid with some biological characteristics of gonad, fertilization success, hatching rate and larval size in Caspian kutum, *Rutilus frisi kutum*. World Journal of Zoology, 5(4):278-271.

Imanpoor, M. R. and Bagheri, T. 2011a. The correlation between biochemical compounds of blood and coelomic fluid of Caspian kutum, *Rutilus frisi kutum*. World Journal of Fish and Marine Sciences, 3(1):16-20.

Imanpoor, M. R. and Bagheri, T. 2011b. Correlations between biochemical factors of coelomic fluid with biological characteristics of gonad, fertilization success, hatching rate and larval size in Caspian kutum, *Rutilus frisi kutum*. World Journal of Fish and Marine Sciences, 3(2):107-111.

Imanpoor, M. R., Bagheri, T. and Hedayati, A. 2011. Relationship of some blood indices with reproduction success in Caspian kutum. Proceedings of the 3rd Aquatic Biodiversity International Conference, Sibiu/Transylvania, p. 99 (abstract).

Imanpoor, M. R., Enayat Gholampour, T. and Zolfaghari, M. 2011. Effect of light and music on growth performance and survival rate of goldfish (*Carassius auratus*). Iranian Journal of Fisheries Sciences, 10(4):641-653.

Imanpoor, M. R., Kamali, A., Hajimoradloo, A. and Bahmani, M. 2006. Effect of phototaxis, light spectrum and photoperiod on survival and growth in *Rutilus frisii kutum* larvae. Journal of Agricultural Sciences and Natural Resources, 13(1):138-145. In Farsi.

Imanpoor, M. R., Nemati, M., Afshar, H. and Roohi, Z. 2018. Effects of stocking density and feeding frequency on the growth parameters and hematocrit of the *Rutilus rutilus caspicus* juvenile. Nova Biologica Reperta, 5(1):45-52. In Farsi.

Imanpoor, M. R. and Roohi, Z. 2015. Effect of a multi-strain probiotic (primalac) on growth performance, some blood biochemical parameters, survival and stress resistance on Caspian kutum (*Rutilus kutum*) fry. Iranian Scientific Fisheries Journal, 24(2):95-103. In Farsi.

Imanpoor, M. R., Salaghi, Z., Roohi, Z., Beikzadeh, A. and Davoodipoor, A. 2015. Effect of

herbal supplement of sangrovit on growth, blood biochemical parameters, survival and resistance to salinity stress of *Cyprinus carpio* fingerlings. Iranian Scientific Fisheries Journal, 24(3):13-22. In Farsi.

Imanpoor, M. R., Sheikhi, Y., Kordjazi, M. and Aghili, S. M. 2009. The effects of carass and pikeperch on survival and some growth indices of common carp (*Cyprinus carpio*). Journal of Agricultural Sciences and Natural Resources, 16(special issue 2):63-69. In Farsi.

Imanpour, M. R., Ahmadi, A. R. and Kordjazi, M. 2009. Effects of stocking density on survival and growth indices of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 18(3):1-10. In Farsi.

Imanpour, M. R., Ahmadi, A. R. and Mehdinezhad, N. 2013. Effect of morning liming on growth performance of cultured carps. Journal of Utilization and Cultivation of Aquatics, 2(4):33-41. In Farsi.

Imanpour, M. R. and Enayat Gholampour, T. 2008. Effects of reproductive migration time on some biological characters of eggs in Gorgan River wild common carp (*Cyprinus carpio*). Journal of Agricultural Sciences and Natural Resources, 15(6):125-131. In Farsi.

Imanpour, M. R. and Enayat Gholampour, T. 2009. The effects of broodstock age on some biological characters of wild common carp *Cyprinus carpio* eggs in Gorganrud River. Journal of Agricultural Sciences and Natural Resources, 16(2):(abstract). In Farsi.

Imanpour, M. R., Esfandiary, M. and Pakravan, S. 2014. Biochemical compositions of ovarian fluid of *Rutilus frisii kutum* (Kamensky, 1901) in the south Caspian Sea and their effects on spermatozoa motility traits. Journal of Animal Researches (Iranian Journal of Biology), 27(3):300-306. In Farsi.

Imanpour, M. R. and Farahi, A. 2011. The effect of different concentrations of clove extract on semen spermatological parameters and hematological characteristics in migrated kutum *Rutilus frisii kutum* to Valiabad River. World Journal of Zoology, 6(2):149-153.

Imanpour, M. R., Fendereski, F. and Kordjazi, M. 2009. The relationship between fish size and sperm volume, hematocrit index, gonadal characteristics and spermatological parameters in *Rutilus rutilus caspicus*. Journal of Agricultural Sciences and Natural Resources, 16(3):60-66. In Farsi.

Imanpour, M. R. and Kamale, A. 2006. The investigation of induced breeding and larval rearing of goldfish *Carassius auratus gibelio* with HCG. Journal of Agricultural Sciences and Natural Resources, 13(2):165-172. In Farsi.

Imanpour, M. R., Mehdinejad, M. and Ahamdi, A. 2014. Effects of different levels of liming at morning on water quality of cultured carp ponds. Journal of Utilization and Cultivation of Aquatics, 3(3):111-119. In Farsi.

Imanpour, M. R., Mehdinejad, M. and Ahamdi, A. 2015. Effects of different amounts of morning liming in carp culture ponds on blood ionic and biochemical parameters of cultured carp. Journal of Utilization and Cultivation of Aquatics, 4(1):39-46. In Farsi.

Imanpour, M. R. and Moosavi, M. 2020. Effect of chlorpyrifos (doresban) agricultural poison on sex hormones and gonadal quality of goldfish (*Carassius auratus*). Journal of Animal Environment, 11(4):265-270. In Farsi.

Imanpour, M. R., Nozari, Z. and Kordjazi, M. 2013. The ionic ratio variations of milt fluid effected by spawning migration place in Caspian roach *Rutilus frisii kutum*. Iranian Journal of Biology, 26(1):111-118. In Farsi.

Imanpour, M. R. and Roohi, Z. 2015. Effect of sangrovit on growth performance, some blood

biochemical parameters, survival and resistance to salinity stress in the Caspian kutum (*Rutilus frisii kutum*) fry. Nova Biologica Reperta. 2(2):122-130. In Farsi.

Imanpour, M. R., Roohi, Z., Sallaghi, Z., Beykzadeh, A. and Davoodipour, A. 2015. Effect of primalac probiotic on growth indices, blood biochemical parameters, survival and resistance to salinity stress in *Cyprinus carpio* fingerlings. Journal of Fisheries Science and Technology, 4(3):17-28. In Farsi.

Imanpour, M. R. and Safari, R. 2009. Effect of maturation stages on gonadal indices and chemical composition of gonad in *Cyprinus carpio* (Cyprinidae). Journal of Agricultural Sciences and Natural Resources, 16(1):35-41. In Farsi.

Imanpour, M. R., Shabani, A., Shabanpour, B. and Mirzaei, S. 2013. Effects of different levels of high unsaturated fatty acids (HUFA) on fish growth, hematocrit and some biochemical blood parameters in kutum (*Rutilus frisii kutum*). Journal of Utilization and Cultivation of Aquatics, 2(2):79-91. In Farsi.

Imanpour, M. R. and Shirmohammadli, R. 2008. Effects of fish size and breeding tubercles on gonadosomatic index and some spermatological parameters in the mahisefid *Rutilus frisii kutum* Kamensky, 1901. Journal of Agricultural Sciences and Natural Resources, 15(6):139-144. In Farsi.

Imanpour Namin, J., Sharifiana, M. and Bozorgi Makrani, A. 2013. Assessment of fish farm effluents on macroinvertebrates based on biological indices in Tajan River (north Iran). Caspian Journal of Environmental Sciences, 11(1):29-39.

Imanpour-Namin J., Mohammadi, Z. and Mohammadi, Y. 2015. Check the invasion of non-native fish in the Zarivar Lake and its effects on native fishes. In: The 1st National Conference on the Protection and Restoration of Wetlands with Emphasis on the Zarivar Lake. Islamic Azad University, Sanandaj, Iran. (www.civilica.com). In Farsi.

Inanloo, K., Alinezhad, S., Zahmatkesh, A. and Aminian Fatideh, B. 2019. Comparison of diets containing *Lactobacillus acidophilus* and *Pediococcus pentosaceus* on growth, hematological and immunological characteristics in juvenile common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 28(3):185-194. In Farsi.

Ionides, M. G. 1937. The régime of the rivers Euphrates and Tigris. E. & F. N. Spon, London. vii + 278 pp.

Ionides, M. G. 1954. The geographical history of the Mesopotamian Plains. Geographical Journal, 120(3):394-397 (with comments by S. Smith and by G. M. Lees and N. L. Falcon).

Irani, A., Hajimoradloo, A., Agh, N, and Ghorbani, R. 2016a. Performance evaluation of barley straw, wood chip, sponge and PVC pure pipe based biofilters in common carp recirculating aquaculture system. Journal of Fisheries Science and Technology, 5(2):1-15. In Farsi.

Irani, A., Hajimoradloo, A., Agh, N, and Ghorbani, R. 2016b. Application and activation of four types of biofilter media in common carp recirculating aquaculture system. Journal of Aquaculture Development, 10(3):13-25. In Farsi.

Iranian Fisheries Company. 1976. In greeting the National Ceremony of the Fiftieth Anniversary of the Pahlavi Kingdom. Iranian Fisheries Company booklet, 18 pp. In Farsi (brief overview of fisheries in the Iranian Caspian Sea).

Iranian Fisheries Company. 1977. Congratulations for the Ceremony greeting the 100th Birthday of King Reza the Great. Iranian Fisheries Company booklet, 17 pp. In Farsi (brief overview of fisheries in the Iranian Caspian Sea; essentially the same as the above).

Iranian Fisheries Research and Training Organization (IFRTO), Tehran. 1995. Aquaculture status and development requirement in the Islamic Republic of Iran. Iranian Fisheries Research and Training Organization (IFRTO), Tehran. 34 pp.

Iranian Fisheries Research and Training Organization (IFRTO), Tehran. 1997. Survey and analysis of aquaculture development research priorities in Iran. Paper presented at the FAO/NACA Workshop on Aquaculture Development Research Priorities and Capacities in Asia, 21-23 May 1997, Bangkok, Thailand. Network of Aquaculture Centres in Asia-Pacific, Bangkok.

Iranshahi, F., Faramarzi, M. and Kiaalvandi, S. 2011. The influence of *Bacillus subtilis* and ascorbic acid on the immune response and serum factors of *Cyprinus carpio*. World Journal of Fish and Marine Sciences, 3(4):335-339.

Iry, M., Bivareh, M., Ranjdoost, M. and Jafaryan, S. 2018. The effect of dietary different level of A-Max ultra prebiotic (yeast culture of *Saccharomyces cerevisiae*) on growth parameters, feed utilization, survival rate and improved stress resistance in common carp fry (*Cyprinus carpio* Linnaeus, 1758). Journal of Utilization and Cultivation of Aquatics, 7(1):11-25. In Farsi.

Islamic Republic of Iran. 2015. The Fifth National Report to the Convention on Biological Diversity. Tehran. 87 pp.

Issar, A. 1967. Hydrogeology of the Central Plateau of Iran. Israel Journal of Earth-Sciences, 16(1):38-39.

IUCN. 1996. 1996 IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland. 70 + 368 pp., annex 10 pp.

IUCN. 2015. The IUCN Red List of Threatened Species. Version 2015.2. International Union for the Conservation of Nature, Gland, Switzerland (www.iucnredlist.org/).

Ivanov, A. P. 1971. A programme for development of inland fisheries in Iran. Food and Agriculture Organization, Rome, United Nations Development Programme, Technical Assistance, UNDP (TA) 3628:57 pp.

Ivanov, V. P. 2000. Biologicheskie resursy Kaspiiskogo Morya [Biological Resources of the Caspian Sea]. Kasp NIRKH, Astrakhan. 100 pp. in Russian, 96 pp. in English, 8 pls.

Ivanov, V. P., Belyaeva, V. N. and Vlasenko, A. D. 1995. Regional’noe raspredelenie promyslovykh resursov Kaspiiskogo Morya [Regional distribution of commercial resources of the Caspian Sea]. Rybnoe Khozyaistvo, 2:18-21.

Ivanov, V. P. and Katunin, D. N. 2001. Report on the results of the Caspian Marine Expedition. Caspian Regional Thematic Center for Management of Bioresources (CRTC MB), Caspian Environmental Programme, Baku, Azerbaijan. 2 volumes.

Izadi, G. 2000. Identification of freshwater fishes of Fars province. Ministry of Jihad-e Keshavarzi, Research Center for Agriculture and Natural Resources of Fars Province. In Farsi.

Izadi, S., Khatibi, A., Asadi, M. and Tahmassebi, D. 2013. Identification status of fish stocks Tigris Salmon (Cyprinidae: *Luciobarbus esocinus*) in Kermanshah province’s rivers. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 7 (abstract).

Izadi Ghorveh, A., Solhi, M., Ghaiumi Mohammadi, H. and Vazan, S. 2015. Investigation the concentration of heavy metals in the sediment of Zayandehrood River bed. International Journal of Advanced Biological and Biomedical Research, 3(1):75-81.

Izyumov, Yu. G. and Kas'yanov, A. N. 1995. Hereditary factors affecting the number of vertebrae in the roach, *Rutilus rutilus*. Journal of Ichthyology, 35(9):20-26.

J

Jabaleh, A. 2020. Compare genetic variation for roach (*Rutilus rutilus caspicus* Linnaeus, 1758) resulting from the proliferation of wild broodstock, breeding and hybrid (wild broodstock x fusion) using microsatellite markers. Journal of Applied Ichthyological Research, 8(1):30-38. In Farsi.

Jabbari, E., Akrami, R. and Chitsaz, H. 2017. Effect of betaine as a feed attractant on growth, survival, body composition and response to environmental stress in kutum (*Rutilus frisii kutum*) fingerling. Iranian Scientific Fisheries Journal, 26(1):83-92. In Farsi.

Jabbari, M. M. and Boustani, F. 2011. Assessment of water pollution of Kowsar Dam Reservoir. International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering, 5(12):768-771.

Jabbari, M. M., Rahimi, B. and Sahraei, H. 2015. Impact of drought on quality and quantity of water resource of Jahrom plain. Cumhuriyet University Faculty of Science, Science Journal 36(4)(Special Issue):826-832.

Jableh, A. R., Ghorbani, R., Kolangi Miandare, H., Bandani, G. and Sherbati, S. 2016. Compare relationship length-weight for roach (*Rutilus rutilus caspicus* Linnaeus 1758) three populations from wild broodstock, breeding and fusion. Journal of Utilization and Cultivation of Aquatics, 4(4):41-51. In Farsi.

Jackson, J. and Wood, R. M. 1980. The earth flexes its muscles. New Scientist, 88(1231):717-720.

Jackson, M. C. and Britton, J. R. 2013. Variation in the trophic overlap of invasive *Pseudorasbora parva* and sympatric cyprinid fishes. Ecology of Freshwater Fish, 22(4):654-657.

Jacobsen, T. 1960. The waters of Ur. Iraq, 22(1-2):174-185.

Jacobsen, T. and Adams, R. M. 1958. Salt and silt in ancient Mesopotamian agriculture. Science, 128(3334):1251-1258.

Jaddi, Y., Safahieh, A., Movahedinia, A., Dajandian, S., Hallajian, A. and Hashemi, R. 2016. Study of sublethal toxicity of pesticide diazinon on certain hematological parameters of Caspian Sea common bream fingerlings (*Abramis brama*). Journal of Veterinary Research, 71(1):17-25. In Farsi.

Jaddi, Y., Safahieh, A. R. and Salighehzadeh, R. 2014. Determination of lethal range and median lethal concentration (LC_{50} 96h) of paraquat on benny fish (*Mesopotamichthys sharpeyi*). Journal of Aquatic Animals and Fisheries, 5(17):21-31. In Farsi.

Jado, A. R. and Zötl, J. G. (Eds.). 1984. Quaternary Period in Saudi Arabia. Volume 2: Sedimentological, hydrogeological, hydrochemical, geomorphological, geochronological and climatological investigations in western Saudi Arabia. Springer-Verlag, Wien. xii + 360 pp.

Jafari, B., Eagderi, S. and Nikmehr, N. 2017. Body shape variation of the genus *Chondrostoma* Agassiz, 1832 in the Tigris basin using geometric morphometrics. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Jafari, F. Z., Hedayati, A. A., Hosseinifar, S. A., Nodeh, A. J. and Bagheri, T. 2018. Effect of pre-treatment with raffinose oligosaccharide and *Pediococcus acidilactici* bacteria on some hematological indices of goldfish (*Carassius auratus*) exposed to silver nanoparticles. Iranian Scientific Fisheries Journal, 27(2):153-160. In Farsi.

Jafari, F. Z., Hedayati, A. A., Hosseinifar, S. A., Nodeh, A. J. and Bagheri, T. 2019. Effect of silver nano particles on carcass composition of goldfish (*Carassius auratus*) pre-treated with raffinose oligosaccharide and *Pediococcus acidilactici* bacteria. Journal of Animal Environment, 11(1):247-252. In Farsi.

Jafari, F. Z., Hedayati, S. A. A., Hoseinifar, S. A., Jafar Nodeh, A. and Bagheri, T. 2019. Effect of raffinose oligosaccharide and *Pediococcus acidilactici* bacteria on carcass composition of goldfish (*Carassius auratus*) exposed to silver nano particles. Journal of Utilization and Cultivation of Aquatics, 8(3):1-9. In Farsi.

Jafari, M., Dalimiasi, A. A. H. and Azarvandi, A. R. 2001. First report of isolation of *Dendronucleata dogieli* from freshwater fish in Iran. Pajouhesh va Sazandegi, 14(1)(50):44-46. In Farsi.

Jafari, M., Kamarudin, M. S., Saad, C. R., Arshad, A., Oryan, S. and Bahmani, M. 2009. Development of morphology in hatchery-reared *Rutilus frisii kutum*. European Journal of Scientific Research, 38(2):296-305.

Jafari, M., Kamarudin, M. S., Saad, C. R., Arshad, A., Oryan, S. and Guilani, M. H. T. 2011. Effects of different diets on growth, survival and body composition of *Rutilus frisii kutum* larvae. Journal of Fisheries and Aquatic Sciences, 6(6):662-668.

Jafari, N. 2009. Ecological integrity of wetland, their functions and sustainable use. Journal of Ecology and Natural Environment, 1(3):45-54.

Jafari, O., Eagderi, S. and Esmaeilzadegan, E. 2014. Morphological study of genus *Alburnoides* Jeitteles, 1861 in Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Jafari, O., Hedayati, A. A. and Keivany, Y. 2016. Length-weight relationships and condition factors of *Alburnus zagrosensis* Coad, 2009, from three rivers of Tigris basin in Iran (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 3(4):316- 319.

Jafari, O., Hedayati, S., Poorbagher, H., Ghorbani, R., Abdolhay, H. and Zeinolabedini, M. 2021. Phenotype-environment associations in common carp, *Cyprinus carpio* Linnaeus 1758, in the southern coast of the Caspian Sea. Iranian Journal of Fisheries Sciences, 20(4):1114-1127.

Jafari, O., Hedayati, S. A., Zeinolabedini, M., Porbagher, H., Ghorbani, R. and Abdolhai, H. A. 2019. Phenotypic variation of *Cyprinus carpio* (Linnaeus, 1758) across southern coasts of the Caspian Sea. Iranian Scientific Fisheries Journal, 28(1):205-209. In Farsi.

Jafari, S. K., Savari, A., Amini, F and Asgari, H. M. 2019. Ecosensing of drought and wet condition in Shadegan Wetland using SPEI Index (years of 1950-2015). Journal of Marine Sciences and Technology, 17(4):1-9. In Farsi.

Jafari, S. M. and Sobhanardakani, S. 2014. Determination of heavy metal (Cu, Pb and Zn) concentrations in muscle tissue of *Hypophthalmichthys molitrix*, *Cyprinus carpio* and *Ctenopharyngodon idella* caught from Zarivar Wetland, western Iran. Current World Environment, 9(3):923-931.

Jafari, S. S. and Rahmani, H. 2015a. Morphological variation in bitterling, *Rhodeus amarus* (Bloch, 1782) in Tajan and Babolrud rivers, Mazandaran Province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet,

p. 71.
Jafari, S. S. and Rahmani, H. 2015b. Some growth parameters of bitterling (*Rhodeus amarus*) in three rivers of southern Caspian Sea basin: Tajan, Siahrood and Babolrood. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 72.
Jafari, V., Bahri, E., Mazandarani, M. and Hajibagloo, A. A. 2020. Effects of different dietary levels of L-arginine on growth indices and survival rate in fingerling common carp (*Cyprinus carpio*). Journal of Animal Environment, 12(1):261-268. In Farsi.
Jafari, V., Bahri, E., Mazandarani, M. R. and Hajibagloo, A. A. 2019. Effects of dietary levels of L-arginine hematological parameters and salinity stress in fingerling common carp (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 13(2):13-25. In Farsi.
Jafari, V., Gholipour, S. N. and Imanpoor, M. R. 2019. Effect of different glycine levels on growth indices, food intake, survival rate and resistance to salinity stress exposure in common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(2):197-204. In Farsi.
Jafari, V., Goli, S. and Nouri, G. 2016. Effects of dietary calcium chloride and glutamine on growth parameters and carcass composition in *Cyprinus carpio*. Journal of Fisheries (Iranian Journal of Natural Resources), 69(2):155-162. In Farsi.
Jafari, V., Ghorbani, R., Goli, S. and Kordjazi, S. 2018. Cultural feasibility and growth of *Capoeta capoeta gracilis* in stage young by using different feeding rates. Journal of Aquaculture Development, 12(3):41-51. In Farsi.
Jafari Kenari, S. S. and Adhami, B. 2017. Short-term effect of *Aloe vera* on blood factors and tissue damage induced by diazinon in common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(4):195-202. In Farsi.
Jafari Kenari, S. S., Rahmani, H., Rahimi, G. and Farhadi, A. 2015. Determination of morphological diversity of wetlands and riverine populations of *Rhodeus amarus* (Bloch, 1782) using traditional and geometric methods. Journal of Applied Ichthyological Research, 3(2):13-28. In Farsi.
Jafari Salim, B., Nabi Bidhendi, Gh. R., Salemi, A., Taherioun, M. and Ardestani, M. 2009. Water quality assessment of Gheshlagh River using water quality indices. Environmental Sciences, 6(4):19-28.
Jafarian, H. and Jafaryan, S. 2014. The inoculation of probiotic bacilli in tank culture system of *Ctenopharyngodon idella* larvae and evaluation their effects on the exploitation of different Artemia nauplii. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Jafarian, H. A., Sahandi, J. and Jafarian, S. 2013. The study of dietary *Saccharomyces cerevisiae* yeast extract supplementation on growth, survival and resistance of common carp (*Cyprinus carpio*) larvae against challenge test. Journal of Utilization and Cultivation of Aquatics, 2(4):129-141. In Farsi.
Jafarinejad, R., Gharaei, A. and Mirdar Harijani, J. 2020. Dietary ginger improves growth performance, blood parameters, antioxidant capacity and gene expression in *Cyprinus carpio*. Iranian Journal of Fisheries Sciences, 19(3):1237-1252.
Jafarpour, A., Yazdanprast, F. and Safari, R. 2017. Physiochemical and textural properties of common carp fermented sausages inoculated with mixed starter cultures of *Pediococcus pentosaceus* and *Lactobacillus plantarum*. Iranian Scientific Fisheries Journal, 26(3):51-

63. In Farsi.
Jafarpour, S. A. 2015. A comparative study on physicochemical characteristics of mince and surimi prepared from common carp (*Cyprinus carpio*) during frozen storage. Journal of Fisheries Science and Technology, 4(3):29-45. In Farsi.
Jafarpour, S. A. 2017. Investigation of oil extracted from common carp fish (*Cyprinus carpio*) by-products using wet rendering, solvent, soxtec and ultrasound method extraction. Journal of Fisheries Science and Technology, 6(2):95-125. In Farsi.
Jafarpour, S. A., Bagheri Mofidi, M. and Motamedzadegan, A. 2014. A feasibility study on application of fish protein powder prepared by freeze-dried technique from mince and surimi of common carp (*Cyprinus carpio*) in formulation of a homemade cookie. Journal of Fisheries, 67(2):191-205. In Farsi.
Jafarpour, S. A., Hajidon, H. and Rezaei, M. 2013. Enhancement of quality properties of common carp (*Cyprinus carpio*) surimi by addition of soy protein isolate. Journal of Research and Innovation in Food Science and Technology, 2(1):93-108. In Farsi.
Jafarpour, S. A., Shabanpour, B. and Shirvani Filabadi, S. 2013. Biochemical properties of fish protein isolate (FPI) from silver carp (*Hypophthalmichthys molitrix*) by application of acid-alkali processes compared to traditional prepared surimi. Ecopersia, 1(3):315-327.
Jafarpour, S. A., Shokri, M. and Shohreh, B. 2015. Chemical, biophysical and sensory characteristic of beef burgers incorporated with common carp (*Cyprinus carpio*) surimi. Journal of Fisheries, 67(4):491-510, 3. In Farsi.
Jafaryan, H., Sahandi, J., Jafaryan, S., Kavian, Z. and Khalili, S. 2013. The role of allochthonous commercial probiotic. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Jafaryan, H., Sahandi, J., Jafaryan, S., Tabasinejad, N. and Tavana, B. G. Z. 2013. The effects of yeast extract for promoting resistance of *Cyprinus carpio* larvae in challenge with stress. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Jafaryan, S., Jafaryan, H. and Bivareh, M. R. 2019. The effect of protexin probiotic on some hematological parameters of common carp juveniles (*Cyprinus carpio* Linnaeus, 1758) before and after long-distance transportation in plastic baggage. Journal of Fisheries Science and Technology, 8(2):75-81. In Farsi.
Jafarzadeh, N., Fataei, E., Vatandoust, S., Hatami, G. R. and Shariati, M. 2015. Bioassessment and quality classification of Balekhloo River based on biological index (fish fauna). Journal of Environmental Science and Technology, 16 (Special Issue):449-459. In Farsi.
Jafarzadeh, N., Rostami, S., Sepehrfar, K. and Lahijanzadeh, A. 2004. Identification of the water pollutant industries in Khuzestan Province. Iranian Journal of Environmental Health Science and Engineering, 1(2):36-42.
Jafarzadeh-Haghiehi, N., Tavasoli, M. H. and Barootkoob, A. 2005. Investigation of Karoon River water quality variation using QUA12E Program. Iran Water Resources Research, 1(2):85-96. In Farsi.
Jaferian, A. 2009. Biological control of aquatic plants by fish. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 99 (abstract).
Jaferian, A., Shakiba, S., Afrasyabi, F. and Mohammadi, K. 2019. Feasibility study on the cultivation of *Cyprinidae*, in springlet of sugarcane farms (Mirza Kuchak Khan-Khorramshahr agro-industry). Journal of Utilization and Cultivation of Aquatics, 8(3):61-71. In Farsi.

Jahanatighi, H., Golizadeh, M., Patimar, R. and Harsij, M. 2020. Investigation of phytoremediation of *Cyperus rotundus* and *Phragmites australis* from *Cyprinus carpio* tank effluent. Journal of Wetland Ecobiology, 11(4): 97-104. In Farsi

Jahanbakhshi, A., Hedayati, A. and Javadimoosavi, M. 2014. Effect of 2-phenoxyethanol as an anesthetic substance on hematological indices of roach (*Rutilus rutilus caspicus*). Journal of Animal Researches (Iranian Journal of Biology), 27(3):338-347. In Farsi.

Jahanbakhshi, A., Shabani, A., Ghazi, S. and Paknejad, H. 2019. Effect of zinc sulfate ($ZnSO_4$) in diet on the growth performance and gene expression of insulin-like growth factor-1 (IGF-1) and ghrelin in goldfish (*Carassius auratus*). Journal of Applied Ichthyological Research, 7(2):63-76. In Farsi.

Jahanbakhshi, A., Shabany, A., Ghazi, Sh. and Kolangi Miandareh, H. 2017. Effects of different level of zinc sulfate ($ZnSO_4$) in diet on the hematocrit and hematology parameters in gold fish (*Carassius auratus*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 19(4):1-11. In Farsi.

Jahanbakhshi, A., Shaluei, F. and Hedayati, A. 2012. Detection of silver nanoparticles (Nanosil©) LC_{50} in silver carp (*Hypophthalmichthys molitrix*) and goldfish (*Carassius auratus*). World Journal of Zoology, 7(2):126-130.

Jahangiri, L. 2013. Genetic diversity study of *Alburnoides eichwaldi* (*sic*) in the rivers Tilabad, Shirabad and Kabudval using microsatellite markers. M.Sc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. In Farsi.

Jahangiri, L., Hajimoradloo, A., Shabany, A. and Forouhar Vajargah, M. 2014. The first report of glochidia infection in *Alburnoides eichwaldii* (Bloch, 1782) population in Sefidroud River. Journal of Animal Environment, 6(2):153-157. In Farsi.

Jahangiri, L., Shabani, A. and Rezaei, H. 2013. Genetic diversity of spirlin (Cyprinidae: *Alburnoides eichwaldi*) (*sic*) in Tilabad and Shirabad streams of Golestan province using microsatellite. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 32 (abstract).

Jahangiri, L. and Shabany, A. 2016. Microsatellite polymorphism in spirlin (*Alburnoides eichwaldii*) populations of Kaboodwal and Sefidrood streams. Journal of Animal Environment, 8(2):113-118. In Farsi.

Jahangiri, L., Shabany, A. and Rezaei, H. 2013. Analysis of the population genetics of three spirlin (*Alburnoides bipunctatus*) populations in Golestan Province using microsatellite marker. Modern Genetics Journal, 8(4)(35):423-434. In Farsi.

Jahangiri, L., Shabany, A. and Rezaei, H. 2014. Genetic comparison of two spirlin populations *Alburnoides eichwaldii* (Bloch, 1782) in Tilabad and Shirabad streams (Golestan, Iran) using microsatellite markers. Journal of Animal Environment, 6(1):35-42. In Farsi.

Jahangoo, V., Gharaei, A. and Akrami, R. 2013. Mannan oligosaccharide prebiotic effect of different levels on growth, survival and body composition in khajoo (*Schizothorax zarudnyi*). Fisheries Magazine, Islamic Azad University of Borujerd Branch, 7(4):27-36. In Farsi.

Jahangoo, V., Gharaei, A. and Akrami, R. 2014. Effect of prebiotic mannanoligosaccharide on growth performance, survival and body composition of *Schizothorax zarudnyi*. Journal of Fisheries, 7(4)(28):27-36. In Farsi.

Jahazi, A., Hoseinifar, S. H., Jafari, V., Hajimoradloo, A., Van Doan, H. and Paolucci, M. 2020.

Dietary supplementation of polyphenols positively affects the innate immune response, oxidative status, and growth performance of common carp, *Cyprinus carpio* L. Aquaculture, 517:734709.

Jalali, B. 1987. Lernaensis in cyprinid cultured fish in Iran. M.Sc. Thesis, University of Godolo, Hungary.

Jalali, B. 1992. Description of *Dogielius molnari* n. sp. (Monogenea: Dactylogyridae) from the gills of an Iranian freshwater fish, *Cyprinion macrostomum* (Heckel). Acta Veterinaria Hungarica, 40(4):239-242.

Jalali, B. 1995a. Monogenean parasites of freshwater fishes of Iran. Ph.D. Thesis, Veterinary Medical Research, Hungarian Academy of Sciences. 105 pp.

Jalali, B. 1995b. Current parasites and parasitic diseases of freshwater fishes in Iran. Proceedings of the Fourth International Symposium of Ichthyology, 3-7 October, Munich, Germany (abstract).

Jalali, B. 1998. Parasites and parasitic diseases of freshwater fishes of Iran. Fisheries Company of Iran, Tehran. 564 pp. In Farsi.

Jalali, B. and Barzegar, M. 2005a. Dactylogirid (*sic*) infection in cultured fish in lake and reservoir in Iran and their epidemiological peculiarities. Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Jalali, B. and Barzegar, M. 2005b. A survey on parasites of gills of fishes of Vahdat Reservoir. Iranian Journal of Veterinary Science, 3:41-50. In Farsi.

Jalali, B. and Barzegar, M. 2005c. Dactylogyrids (Dactylogyridae: Monogenea) on common carp (*Cyprinus carpio* L.) in freshwaters of Iran and description of the pathogenicity of *D. sahuensis*. Journal of Agricultural Science and Technology, 7(1-2):9-16.

Jalali, B. and Barzegar, M. 2006. Fish parasites in Zarivar Lake. Journal of Agricultural Science and Technology, 8(1):47-58.

Jalali, B., Barzegar, M., Asadollah, S., Mehdipour, M., Maghsodloo, A., Gheshlaghi, P., Abdollahi, F., Mansori, H. and Fakhri, Z. 2007. Identifications of parasites of some native fishes in headwaters of Zayandeh-Roud River: the first record of *Allocreadium laymani* Bychowsky, 1962, in Iran. Iranian Journal of Veterinary Sciences, 4(1):63-70. In Farsi.

Jalali, B., Barzegar, M. and Shamsi, Sh. 2000. Occurrence and description of *Dactylogyrus sphyrna* Linstow, 1878 (Monogenea: Dactylogyridae) on the gills of an Iranian endemic fish *Leuciscus persidis* Coad, 1981 (*sic*) as a new host. Iranian Journal of Fisheries Sciences, 2(2):71-76, 104.

Jalali, B., Mahbobi Soofiani, N., Asadollah, S. and Barzegar, M. 2012. An investigation on fish parasites in Hanna Wetland, Semirom, Isfahan Province. Iranian Scientific Fisheries Journal, 21(1):25-38. In Farsi.

Jalali, B. and Molnár, K. 1990a. Occurrence of monogeneans on the freshwater fishes of Iran: Dactylogyridae from fish of natural waters and description of *Dogielius mokhayeri* sp.n. Parasitologia Hungarica, 23:27-32.

Jalali, B. and Molnár, K. 1990b. Occurrence of monogeneans on freshwater fishes in Iran: *Dactylogyrus* spp. on cultured Iranian fishes. Acta Veterinaria Hungarica, 38(4):239-242.

Jalali, B., Papp, M. and Molnár, K. 1995. Four new *Dactylogyrus* species (Monogenea: Dactylogyridae) from Iranian fishes. Folia Parasitologica, 42(2):97-101.

Jalali, B. and Rohani, M. 1997. Monogeneans parasites of the southeastern part of Iran and their

zoogeographical peculiarities. Third International Symposium of Monogenea, 25-30 August 1997, Czech Republic, Papers and Abstracts, p. 75.

Jalali, B. and Shamsi, Sh. 2005a. Government approaches and research priorities for monogenean infections in aquaculture. 5th International Symposium on Monogenea, 8-12 August 2005, Zhongshan University, Guangzhou, China (title).

Jalali, B. and Shamsi, Sh. 2005b. Dactylogyrus infection of introduced fishes (common carp and other major species of Chinese cyprinids) in Iran. 5th International Symposium on Monogenea, 8-12 August 2005, Zhongshan University, Guangzhou, China (title).

Jalali, B., Shamsi, Sh. and Barzegar, M. 2005. Occurrence of *Gyrodactylus* spp. (Monogenea: Gyrodactylidae) from Iranian freshwater fishes. Iranian Journal of Fisheries Sciences, 4(2):19-30, 114.

Jalali, B., Shamsi, S. and Imanzadeh, F. 2001. Specific composition and morphological peculiarities of endemic monogenean parasites of freshwater fishes of Iran. In: ISM 4: 4th International Symposium on Monogenea, Brisbane, Australia, 9-13 July 2001, p. 97 (abstract).

Jalali, B., Shamsi, Sh. and Imanzadeh, F. 2001. Specific composition and morphological peculiarities of endemic monogenean parasites of freshwater fishes of Iran. Iranian Journal of Fisheries Sciences, 3(1):13-22, 89.

Jalali, B., Shamsi, S. and Molnár, K. 2000. New *Dactylogyrus* species (Monogenea, Dactylogyridae) from cyprinid fishes of the Bahu-Kalat River in southeast Iran. Acta Parasitologia, 45(4):289-294.

Jalali, J. B., Barzegar, M. and Sohrabi, H. I. 2002. Preliminary survey on the parasites of some fishes in Zarivar Lake. Iranian Journal of Marine Sciences, 1(2):27-40, 86. In Farsi.

Jalali, M., Khosravi, M., Rohani Haeri, E., Ghorbanzadeh, A. and Parsa Khanegah, A. 2008. Survey on the prevalence and intensity of Ligulosis caused by *Ligula intestinalis*, L. 1758 in *Chalcalburnus* sp. in Zarivar Lake and changes in sexual hormones levels in infected fishes. Iranian Journal of Veterinary Sciences, 26:15-19. In Farsi.

Jalali, S., Jamili, Sh., Borani, M., Ramezanifard, E. and Sepahdari, A. 2020. Ontogenic development of digestive accessory glands in larval and juvenile vimba bream, *Vimba vimba* (Pallas, 1814). Iranian Journal of Fisheries Sciences, 19(1):99-110.

Jalali, S., Jamili, Sh., Sayyad Bourani, M., Ramezani-Fard, E. and Sepahdari, A. 2019. Ontogenic development of the digestive tract in larval and juvenile vimba bream, *Vimba vimba*. Anatomical Science International, 94(2):192-198.

Jalali, S., Jamili, Sh., Sayyad-Bourani, M., Ramezani-Fard, E. and Sepahdari, A. 2018. An investigation of ontogenic development of mouth and its size in larval and juvenile of *Vimba vimba.* Iranian Scientific Fisheries Journal, 27(3):65-73. In Farsi.

Jalali Jafari, B. 1998. Parasites and parasitic diseases of freshwater fishes of Iran. Iranian Fisheries Research Organization Press, Tehran. 564 pp. In Farsi.

Jalali Jafari, B. and Miar, A. 2011. Metazoan parasite community of *Capoeta damascina* (Valenciennes in Cuvier and Valenciennes, 1842), Tigris basin, Mesopotamian region - a checklist. Iranian Journal of Veterinary Research, Shiraz University, 12(3)(36):265-270.

Jalali Mottahari, R. S., Bozorgnia, A., Ghiasi, M., Farabi, S. M. V. and Tossi, M. 2013. Impact of copper sulphate on hematological and some biochemical parameters of common carp (*Cyprinus carpio* L., 1758) in different pH. World Journal of Fish and Marine Sciences, 5(5):486-491.

Jalali Roshan, S. 2013. Taxonomic study of three species of the genus *Alburnus* (*A. chalcoides*,

A. atropatenae, A. mossulensis) in Iran using geometric morphometric and osteological methods. M.Sc. Thesis, University of Tehran, Karaj.

Jalali Roshan, S., Eagderi, S. and Nasri, M. 2013. Morphological comparison of four species of genus *Alburnus* (Cyprinidae: *Alburnus chalcoides*, *A. filippii*, *A. mossulensis*, *A. atropatenae*) from Khazar, Urmia and Tigris basins. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 30 (abstract).

Jalalian, M., Shabanpour, B., Shabani, A., Gorgin, S. and Khomeiri, M. 2012. Quality assessment of pre- and post-rigor frozen silver carp (*Hypophthalmichthys molitrix*), during refrigerated storage (4±1ºC). Iranian Journal of Food Science and Technology, 8(1):101-111. In Farsi.

Jalili, P. 2015. Phylogeny of the genus of Iranian cyprinids using osteological characters in Iran using geometric morphometric and osteological methods. M.Sc. Thesis, University of Tehran, Karaj.

Jalili, P. and Eagderi, S. 2014a. Osteological study of Iran cave barb (*Iranocypris typhlops* Brun (*sic*) and Kaiser, 1944). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Jalili, P. and Eagderi, S. 2014b. Phylogeny of the genus *Garra* in Iran based on the skeleton of the caudal fin. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Jalili, P. and Eagderi, S. 2014c. Osteological description of Iran cave barb (*Iranocypris typhlops* Bruun & Kaiser, 1944). University Journal of Zoology, Rajshahi University, 33:1-7.

Jalili, P., Eagderi, S., Azimi, H. and Mousavi-Sabet, H. 2015. Osteological description of the southern king fish, *Alburnus mossulensis* from Iranian part of the Tigris River drainage. ABAH Bioflux, 7(2):113-121.

Jalili, P., Eagderi, S. and Keivany, Y, 2015. Body shape comparison of Kura bleak (*Alburnus filippii*) in Aras and Ahar-Chai rivers using geometric morphometric approach. Research in Zoology, 5(1):20-24.

Jalili, P., Eagderi, S., Latifnezhad, S. and Seifali, M. 2019. Skeletal structure of shir mahi *Schizothorax pelzami* from Dasht-e-Kavir basin. Journal of Applied Biology, 32(2):9-22. In Farsi.

Jalili, P., Eagderi, S., Nasri, M. and Mousavi-Sabet, H. 2015. Descriptive osteology study of *Alburnus amirkabiri* (Cypriniformes: Cyprinidae), a newly described species from Namak Lake basin, central Iran. Bulletin of the Iraq Natural History Museum, 13(4):51-62.

Jalili, P., Eagderi, S. and Nikmehr, N. 2015. Comparison of the caudal skeleton of the species *Barbus lacerta* (Heckel, 1843) and *Barbus cyri* (De Filippi, 1865). The Third Iranian Conference of Ichthyology, Shiraz University, 6-7 May 2015 (abstract).

Jalili, P., Eagderi, S., Nikmehr, N. and Keivany, Y. 2015. Descriptive osteology of *Barbus cyri* (Teleostei: Cyprinidae) from southern Caspian Sea basin. Iranian Journal of Ichthyology, 2(2):105-112.

Jalili, P., Eagderi, S. and Zamani Faradonbeh, M. 2015. Comparative study of waspi, *Cabdio morar* (Hamilton, 1822) in Mashkil and Makran basins - southeast of Iran. Journal of Applied Ichthyological Research, 3(2):79-96. In Farsi.

Jalili, S. 2007. Influence of cold storage time on the protein changes and fatty acids deterioration of (*Rutilus frisii kutum*) during frozen storage. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 160 pp. In Farsi.

Jalili, S., Chitsazan, M. and Saatsaz, M. 2014. The study of hydrogeological and hydrogeochemical characteristics of Abhar Plain, Zanjan Province, Iran. International Bulletin of Water Resources and Development, 2(3):29-49. In Farsi.

Jalili, S. H., Farhoosh, R., Koocheki, A. and Motallebi, A. 2019. Microencapsulated kilka fish oil stability using functional properties of silver carp (*Hypophthalmichthys molitrix*) skin hydrolysate. Iranian Scientific Fisheries Journal, 27(6):67-78. In Farsi.

Jalili, S. H. and Hamrang Omshi, A. 2011. Physicochemical and sensory quality changes of surimi from silver carp (*Hypophthalmichthys molitrix*) in frozen storage at -18°C. Iranian Scientific Fisheries Journal, 20(3):33-44. In Farsi.

Jamali, H., Eagderi, S., Esmaeilzadegan, E. and Patimar, R. 2015. Age, growth and some biological characteristics of silver bream (*Blicca bjoerkna* L., 1758) (Cyprinidae) from Aras Dam Lake in northwest of Iran. International Journal of Aquatic Biology, 3(1):35-41.

Jamali, H., Jafaryan, H., Nazerian, S. and Sadegh Aramli, M. 2015. Effect of probiotic *Bacillus* spp. on growth and feed efficiency of common carp, grass carp and bighead larvae fed with nauplii of different *Artemia* species. Journal of Fisheries Science and Technology, 4(2):27-43. In Farsi.

Jamali, Z., Jozi, S. A. and Hedayatifard, M. 2009. Hydrochemical study of Kooseh-Abband Wetland for warm water fish culture, northern Iran. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 123 (abstract).

Jamali, Z., Jozi, S. A. and Hedayatifard, M. 2012. Evaluation of hydro-chemical and quality parameters of wetlands in Mazandaran Province (northern Iran) for aquaculture purposes development. Journal of Fisheries, 6(2):1-12. In Farsi.

Jamali Ashtiani, A., Eagderi, S., Khorasani, N. A. and Zamani Faradonbe, M. 2016. Comparison of body shape features of Kura barbel (*Barbus lacerta*, Heckel 1834) in Caspian, Tigris and Urmia Lake basins using geometric morphometrics technique. Journal of Animal Environment, 7(4):143-150. In Farsi.

Jamili, S., Kousha, A. and Askarian, F. 2006. *In vivo* investigation on effect of lead nitrate on blood serum electrolyte of bighead carp Aristischtis (*sic*) nobilis. World Aquaculture Society, Aqua 2006, May 9-13. Florence, Italy (abstract).

Jamalpour, M. 1998. Biodiversity of fish species in Helleh River (an ecological approach). M.Sc. Thesis, Tarbiat Modarres University. In Farsi.

Jamshid Poodeh, M., Esmaeili Fereidouni, A., Ouraji, H. and Jani Khalili, Kh. 2014. Replacement of fish oil with vegetable oils based diets on growth and survival of the Caspian kutum (*Rutilus kutum*) fingerlings. Journal of Animal Researches (Iranian Journal of Biology), 27(3):329-337. In Farsi.

Jamshidi, A., Ojagh, S. M., Shabanpour, B. and Kazeminia, S. 2013. The evaluation of product shape and different particle size of breading on quality and sensory properties of fish finger and fish nugget made from silver carp (*Hypophthalmichthys molitrix*). Journal of Utilization and Cultivation of Aquatics, 2(3):11-26. In Farsi.

Jamshidi, S., Kalbassi, M. R. and Sadeghizadeh, M. 2009. Inheritance of RAPD marker in female grass carp (*Ctenopharyngodon idella*), male bighead carp (*Hypophthalmichthys nobilis*) and their F1 hybrids. Iranian Journal of Fisheries Sciences, 8(1):47-56.

Janadeleh, H. and Kardani, M. 2016. Heavy metal concentrations and human health risk assessment for three common species of fish from Karkheh River, Iran. Iranian Journal of Toxicology, 10(6):31-37.

Jangaran Nejad, A., Peyghan, R., Najafzadeh Varzi, H. and Shahriyari, A. 2016. Effect of florfenicol following bath and oral administration on hematological and biochemical parameters in common carp, *Cyprinus carpio*. Journal of Animal Environment, 8(1):237-242. In Farsi.

Jani Khalili, Kh., Oraji, H., Keramat, A. S., Esmaili Feridoni, A. and Rajabnia, M. 2019. Effect of using different types of organic animal manure on plankton abundance, growth performance and survival of carps fry in fiber glass tanks. Iranian Scientific Fisheries Journal, 28(2):49-58. In Farsi.

Japan International Cooperation Agency. 2005. The Study on Integrated Management for Ecosystem Conservation of the Anzali Wetland in the Islamic Republic of Iran. Final Report Volume I: Executive Summary, Volume II: Main Report, Volume III: Supporting Report, Volume IV: Data Book. Department of the Environment, Jihad-e Agriculture, Tehran and Nippon Koei Co. Ltd.

Japan International Cooperation Agency and CTI Engineering Co. Ltd. 2010. The Study of Integrated Water Resources Management for Sefidrud River Basin in the Islamic Republic of Iran. Water Resources Management Company, Ministry of Energy, Islamic Republic of Iran. 3 volumes.

Japan International Cooperation Agency (JICA), CTI Engineering International Co., Ltd. and CTI Engineering Co., Ltd. 2016. Data collection survey on hydrological cycle of Lake Urmia basin in the Islamic Republic of Iran. Final report. Islamic Republic of Iran, Ministry of Energy (MOE) and Water Resource Management Company (WRMC). xi + 184 pp., 59 annexes.

Jarafpour, A., Alinejad, A., Yeganeh, S. and Safari, R. 2013. Microbial and biochemical characteristics of fermented fish sausage from common carp (*Cyprinus carpio*) mince by application of *Pediococcus pentasaceus* at different incubation temperatures. Iranian Scientific Fisheries Journal, 22(2):35-46. In Farsi.

Jarvis, P. L. 2011. Biological synopsis of *Garra rufa*. Canadian Manuscript Report of Fisheries and Aquatic Sciences, 2946:vi + 14 pp.

Jasim, A. A. and Ahmed, M. M. 2009. Fish population structure in Tigris River, Mosul. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 67 (abstract).

Jasim, B. M. 1980. Age and growth of shilik, *Aspius vorax* Heckel, and common carp, *Cyprinus carpio* L., in Habanniyah Lake. M.Sc. Thesis, University of Baghdad. 82 pp.

Jasim, B. M. 1988. Tolerance and adaptation of goldfish Carassius auratus (L.) to salinity. Journal of Biological Science Research, Baghdad, 19(1):149-154.

Jaubert, M. le Comte. 1843. Relations de Voyages en Orient de 1830 à 1838, par Aucher-Éloy, revues et annotées. Première Partie. Librairie Encyclopédique de Roret, Paris. xxxi + 364 pp.

Javadanekherd, A., Esmaeilisari, A. and Bahramifar, N. 2012. Role of feeding diets and habitat condition in the accumulation of the organic pollutants in the international Anzali Wetland fish. Journal of Utilization and Cultivation of Aquatics, 1(2):31-50. In Farsi.

Javadi, S. and Arabsolghar, N. 2013. Manifestation of water purity in Sa'adi Shirazi's Tomb. Bagh-i-Nazar, 10(26):13-22. In Farsi.

Javadian, S. R., Gharibi, F., Soltani, S. and Bahram, S. 2015. The effects of antibacterial and antioxidant activities of sodium alginate incorporated with *Enteromorpha* sp. extract on common carp (*Cyprinus carpio*) fillet during chilled storage. Journal of Aquatic Animals and Fisheries, 6(21):23-35. In Farsi.

Javadian, R., Rezaei, M., Sahari, M. A. and Hosseni, S. V. 2003. Effect of ice storage on lipid changes in silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Marine Sciences, 2(4):19-26. In Farsi.

Javadzadeh, N., Paziresh, N. and Mabudi, H. 2019. Determination of anesthetic, lethal concentration and effects of *Eugenia caryophyllata* on hematological indices of *Barbus barbulus*. Journal of Utilization and Cultivation of Aquatics, 7(4):41-52. In Farsi.

Javadzadeh, N., Teymouri, M. H. and Mabudi, H. 2016. The investigation of 2-phenoxyethanol on liver tissue of *Barbus grypus*. Journal of Animal Biology, 8(2):1-9. In Farsi.

Javaheri, M. 1998. Age structure and growth of *Capoeta capoeta gracilis* in Zaringol River. B.Sc. Seminar, Agricultural Sciences and Natural Resources University, Gorgan. 30 pp. In Farsi.

Javaheri Baboli, M. and Anvari, M. 2018. Determination of optimum weaning time of shirbot (*Barbus grypus* Heckel, 1843) larvae. Turkish Journal of Fisheries and Aquatic Sciences, 18(12):1371-1377.

Javaheri Baboli, M., Ataei, A., Taati, R. and Kalantar Hormozi, Z. 2016. Evaluation of the effects of immunoster on growth, body composition and intestine bacterial flora of common carp (*Cyprinus carpio*) fingerlings. Breeding and Aquaculture Sciences Quarterly, 3(7):61-74. In Farsi.

Javaheri Baboli, M. and Fazeli Rad, S. M. 2016. Surveys of changes in fatty acids composition during larval development of shirbot (*Barbus grypus*). Journal of Animal Environment, 7(4):151-158. In Farsi.

Javaheri Baboli, M. and Hosseini Najd Gerami, E. 2018. Determination of seasonal variations in the liver and muscle fatty acid composition of benni fish (*Mesopotamichthys sharpeyi*) in Shadegan Wetland. Journal of Wetland Ecobiology, 9(4):23-34. In Farsi.

Javaheri Baboli, M., Khodadadi, M. and Taghani Niya, M. 2019. Effects of seasons on the composition and the ratio of omega-3 to omega-6 fatty acids of muscle tissue of *Barbus xanthopterus*. Journal of Wetland Ecobiology, 11(3):31-40. In Farsi

Javaheri Baboli, M., Oraji, H. and Ghobadi, S. 2020. Seasonal variations in the liver and muscle fatty acid composition of *Barbus luteus* from Karkhe river (Khouzestan, Iran). Journal of Aquaculture Development, 14(2):25-38. In Farsi.

Javaheri Baboli, M. and Sayahi, A. 2014. Age and growth of *Carasobarbus luteus* (Heckel, 1843) in Karkheh River, southwestern Iran. Environmental and Experimental Biology, 12:107-111.

Javaheri Baboli, M., Sayahi, A. and Nejad, M. C. D. 2013. Condition factor, diet and gonadosomatic index of *Carasobarbus luteus* (Heckel, 1843) in Karkheh River, Iran. Journal of Biodiversity and Environmental Sciences, 3(1):83-87.

Javaheri Baboli, M. and Taghavi Niya, M. 2014. Reproduction biology of *Capoeta trutta* (Heckel, 1843) in the Shour River, southwest Iran. Croatian Journal of Fisheries, 72(4):150-155.

Javaheri Baboli, M., Taghavi Niya, M. and Pazira, A. 2012. Length-weight relationship and condition factor of *Copoetta* (*sic*) *trutta* in Shour River downstream. Advances in Environmental Biology, 6(5):1731-1734.

Javahery Baboli, M., Maktabi, P., Jafarnejadi, A. R. and Askary Sary, A. 2013. Investigation on lead concentration on common carp (*Cyprinus carpio*) tissues, sediment and water of some warm water fish farms of Khouzestan Province. Journal of Aquaculture Development, 6(2):11-22. In Farsi.

Javaherzadeh Dezfool, F., Alishahi, M., Chelemal Dezfoolnezhad, M. and Javaheri, M. 2012. Effect of different levels of vitamin C on the immunological and hematological parameters in *Barbus sharpeyi*. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 6(1):47-56. In Farsi.

Javanshir A., Shapoori, M. and Jamili, S. 2008. Diversity of benthic invertebrates fauna and secondary production in southern Caspian Sea basin case study on Tajan River estuary. Journal of Fisheries and Aquatic Science, 3(6):353-365.

Javid, H. and Jafarpour, S. A. 2016. Effect of microbial transglutaminase (MTGase) on textural properties of bighead fish (*Hypophthalmichthys nobilis*) surimi. Journal of Fisheries Science and Technology, 5(1):43-67. In Farsi.

Javid, L. and Jalalian, H. 2019. The role of rural settlements on emerge of environmental challenges in sensitive ecosystems (case study of Lake Zarivar, Iran). Environmental Researches, 10(19):79-90. In Farsi.

Javid Rahmdel, K., Allaf Noverian, H., Falahatkar, B. and Babakhani Lashkan, A. 2017. Effect of fish meal replacement with sunflower meal on growth indices and body composition of common carp (*Cyprinus carpio*) fingerlings. Iranian Scientific Fisheries Journal, 26(2):25-35. In Farsi.

Jawad, L. A. 2003a. Biochemical approaches: their present usage and future application in the systematic problems of the freshwater fishes of Mesopotamia. Anales de Biologia, 25:199-208.

Jawad, L. A. 2003b. Impact of environmental change on the freshwater fish fauna of Iraq. International Journal of Environmental Studies, 60(6):581-593.

Jawad, L. A. 2010. Book review of "Freshwater Fishes of Iraq". Pensoft Series Faunistica No. 93. By B. Coad. 274 pp. Published by Pensoft Publishers, Moscow. 2010. Price €48.00. ISBN: 978-954-642-530-0. Journal of Fish Biology, 77(4):1041-1042.

Jawad, L. A. 2012. History of the study of the fish fauna of Iraq. Water Research and Management, 2(3):11-20.

Jawad, L. A. (Ed.). 2021. Southern Iraq's Marshes - Their Environment and Conservation. Springer, Coastal Research Library, 36:xxiii + 815 pp.

Jawad, L. A., Abed, J. M., Hussain, S. A. and Ünlü, E. 2018. Vertebral dimensions in the genus *Carasobarbus* (Teleostei: Cyprinidae). Journal of Ichthyology, 58(6):780-794.

Jawad, L. A., Al-Faisal, A. and Al-Mukhtar, M. 2012. Presence of the non-indigenous fish species, gibel carp, *Carassius gibelio* (Family: Cyprinidae) in Basrah Province freshwater systems, Iraq. Water Research and Management, 2(4):41-44.

Jawad, L. A., Al-Faisal, A. J. and Al-Mukhtar, M. 2015. A case of vertebral coalescence in *Luciobarbus xanthopterus* (Heckel, 1843) (Pisces: Cyprinidae) obtained from the lower reaches of Mesopotamia. Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa", 57(2):127-132.

Jawad, L. A. and Alwan, N. 2020. Osteological characters to define six species of the *Capoeta damascina* species complex (Cypriniformes: Cyprinidae). Journal of Ichthyology, 60(2):182-203.

Jawad, L. A., Ibáñez, A. L., Sadighzadeh, Z., Näslund, J. and Ünlü, E.2017. Scale deformity descriptions for 23 species of fish, from various geographical areas. Marine and Freshwater Research, 69(2) 313-324.

Jawad, L. A. and Kousha, A. 2011. A case of vertebral coalescence and lateral line deformity in *Hypophthalmichthys nobilis* (Richardson, 1844) obtained from aquaculture activity in

Iran. Bolletino Museo regionale di Scienze naturali Torino, 28(1):29-36.
Jawad, L. A., McKenzie, A. and Al-Noor, S. S. 2009. Relationship between opercular girth, maximum girth and total length of fishes caught in gillnets in the estuarine and lower river sections of Shatt al-Arab River (Basrah Province, Iraq). Journal of Applied Ichthyology, 25(4):470-473.
Jawad, L. A. J. 1975. Biometric studies on three Barbus species from Basrah waters, Basrah, Iraq. The Arabian Gulf Journal, University of Basrah, 3:212-247.
Jawad, L. A. J. 2004. Preliminary study on the use of eye lens diameter and weight as an age indicator in two cyprinid fishes collected from Basrah, Iraq. Bollettino del Museo Regionale di Scienze Naturali di Torino, 21(1):151-158.
Jayaram, K. C. 1981. The Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka - A Handbook. The Director, Zoological Survey of India, Calcutta. xxii + 475 pp., 13 pls.
Jayaram, K. C 1999. The Freshwater Fishes of the Indian Region. Narendra Publishing House, Delhi. xxvii + 551 pp., 18 pls.
Jayaram, K. C. and Das, J. J. 2000. Revision of the genus *Labeo* Cuvier from the Indian region with a discussion on its phylogeny and zoogeography (Pisces: Cypriniformes, Cyprinidae, Cyprininae). Records of the Zoological Survey of India, Occasional Paper, 183:1-143, pls. 1-2.
Jazebi Zadeh, M. K. and Shirin Abadi, M. 2007. Identification and estimation of the population of fishes in Namroud River. Journal of Environmental Science and Technology, 9(3)(34):103-111. In Farsi.
Jazebi Zadeh, M. K. and Shirin Abadi, M. 2008. Identification and estimation of the population of fishes in Namroud River. Journal of Environmental Science and Technology, 10(1)(36):127-136. In Farsi.
Jazebizadeh, K. 1983. Study on parasitic diseases of fishes of Zarivar Lake. Environmental Protection Organization of Iran Publication, Tehran. 19 pp. In Farsi.
Jazebizadeh, M. K. and Yekta, A. A. 2008. Identification and estimation of Namrud River's fisher above the Tehran Gezel Aquaculture Farm by electroshocker. Journal of Environmental Science and Technology, 36(special issue).
Jebeleh, A., Ghorbani, R., Bandani, G. A., Pourmozaffar, S., Khajeh Rahmi, A. E., Tamadoni Jahromi, S. and Gozari, M. 2020. Evaluation of the diet of juveniles roach (*Rutilus caspicus*) in earthen ponds of Syjwal Bony Fish Breeding Center. Journal of Animal Biology, 12(3):1-13. In Farsi.
Jeihon, M. and Javaheri Baboli, M. 2017. Changes in fatty acid composition in embryonic and larval development stages of bighead carp *Hypophthalmichthys nobilis*. Journal of Aquaculture Development, 11(3):1-11. In Farsi.
Jeney, Z. 1984. Consultancy report in Fish Health Management. Iranian Fisheries Organisation, Tehran, Iran. 60 pp.
Jenkins, J. T. 1910. Notes on fish from India and Persia, with descriptions of new species. 1. On a collection of fishes made by W. T. Blanford in 1872 in Persia and Baluchistan. Records of the Indian Museum, 5(XII):123-128, pl. VI.
Jennings, D. P. 1988. Bighead carp (*Hypophthalmichthys nobilis*): a biological synopsis. U.S. Fish and Wildlife Service Biological Report, 88(29):vii + 47 pp.
Jerfi, E. 2016. Preliminary study of the possibility of triploid induction using hydrothermal shock in Bani fish. Fisheries Science Research Institute, Aquaculture Research Institute of the

South of the Country, Final report of the research project. In Farsi.
Jiad, J. H. and Hameed, A-H. M. 1986. Relationship between age and blood contents of *Barbus sharpeyi*. Journal of Biological Sciences Research, Baghdad, 17(2):31-41. In Arabic.
Jiad, J. H., Hameed, A-H. M. and Al-Faisal, A-H. M. 1984. Study of age, growth and blood contents of *Barbus grypus* Heckel in Al-Hindiya dam. Journal of Biological Sciences Research, Baghdad, 15(2):29-48.
Job, T. J. 1960a. Fish crops from multipurpose dams in the Middle East. FAO in the Near East, “A Quarterly Review”, Food and Agriculture Organization, Cairo, 1960(1):2-14.
Job, T. J. 1960b. Travel report on a visit to Iran from 18 September to 5 October 1960. Food and Agriculture Organization, Rome, NEFi/T/60:12 pp.
Job, T. J. 1961a. Fisheries notes. FAO in the Near East, “A Quarterly Review”, Food and Agriculture Organization, Cairo, 3(2):23.
Job, T. J. 1961b. Iran - background information. Food and Agriculture Organization, Rome, NEFi - Iran Inf., 26 pp., appendix (mimeo).
Job, T. J. 1965. Travel report on a visit to Iran from 20 July to 2 August 1965. Food and Agriculture Organization, Rome, NECFi-T/65-2, 10 pp., 3 appendices (mimeo).
Job, T. J. 1967. Status of fish culture in the Near East region, pp. 54-69. In: Pillay, T. V. R. (Ed.). Proceedings of the FAO World Symposium on warm-water pond fish culture. Food and Agriculture Organization, Rome, Fisheries Report, 44, volume 2:174 pp.
Johargholizadeh, G. A. 2006. Ecological survey of helminth parasites in *Capoeta trutta* and *Cyprinion macrostomum* from Dez River (Khuzestan Province). M.Sc. Thesis, School of Biology, University of Tehran.
Johari, N., Kazemian, M., Shapoori, M. and Vatandoost, S. 2010. Comparison of morphometric and morphomeristic characteristics between male and female siah mahi (*Capoeta capoeta*) in Talar River of the Mazandaran Province. Journal of Marine Biology, 2(2):53-64. In Farsi.
Johari, S. A. and Asghari, S. 2009. Identification and distribution of fish fauna in qanats and standing rivers of Qae’nat County (South Khorasan). 13th European Congress of Ichthyology, 6-12 September 2009, Klaipeda, Lithuania (abstract).
Johari, S. A., Coad, B. W. and Asghari, S. 2009. Biological and morphometric characteristics of siah mahi, *Capoeta fusca* a cyprinid fish living in the qanats of Birjand County (South Khorasan Province, Islamic Republic of Iran). 13th European Congress of Ichthyology, 6-12 September 2009, Klaipeda, Lithuania (abstract).
Johari, S. A., Coad, B. W., Mazloomi, S., Kheyri, M. and Asghari, S. 2009. Biological and morphometric characteristics of *Capoeta fusca*, a cyprinid fish living in the qanats of south Khorasan, Iran (Osteichthyes: Cyprinidae). Zoology in the Middle East, 47(1):63-70.
Johari, S. A., Mazloomi, S., Kheyri, M. and Asghari, S. 2008. Some biological and morphometric characters of siah mah, *Capoeta fusca* (Nikolski, 1897) living in the qanats of Birjand County. Journal of Marine Sciences and Technology, 7(1-2):75-85. In Farsi.
Johari, S. A., Mazloumi, S., Abdoli, A., Khajavi, H. and Asghari, S. 2010. Identification and distribution of fish fauna in qanats and standing rivers of Qae’nat (South Khorasan Province, I. R. Iran). Journal of Fisheries, 4(1):115-120. In Farsi.
Johari, S. A., Sarkheil, M. Asghari, S., Haghighat, F., Dekaniand, L. and Keyvanshokooh, S. 2020. Comparative toxicity of nanoparticulate and ionic copper following dietary

exposure to common carp (*Cyprinus carpio*). Comparative Biochemistry and Physiology, Part C, Toxicology and Pharmacology, 229:108680.

Jolodar, A., Seghatoleslami, S., Seyfiabad Shapouri, M. R. and Mesbah, M. 2011. Identification of a cDNA sequence coding for Kruppel-like factor 2B (KLF2B) from the skin mucosa of common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Research, Shiraz University, 12(2):150-155.

Jomehpour, M. 2009. Qanat irrigation systems as important and ingenious agricultural heritage: case study of the qanats of Kashan, Iran. International Journal of Environmental Studies, 66(3):297-315.

Jonasson, G. 1987. Islamic Republic of Iran. Development of the artisanal and industrial fisheries. A report prepared for the Fisheries Development Project, Food and Agriculture Organization, Rome. 8 pp.

Joneidi, M. J., Khodabandeh, A., Ghafouri, M. R. and Chariat, M. 1971. Lee (*sic*) eaux minerales (*sic*) de L'Iran. University of Tehran Environmental Studies, 4:149-156.

Jones, L. A., Mandrak, N. E. and Cudmore, B. 2017. Updated (2003-2015) biological synopsis of grass carp (*Ctenopharyngodon idella*). Canadian Science Advisory Secretariat (CSAS) Research Document, 2016/102:iv + 63 pp.

Jooyandeh, F., Sadeghpour, A., Khara, H. and Uallah Pajand, Z. 2014. LC50 evaluation of potassium permanganate disinfectant effects on microorganisms histology of skin and gills of grass carp (*Ctenopharyngodon idella* (Valenciennes, 1844). Journal of Animal Physiology and Development (Journal of Biological Sciences), 7(1):41-48. In Farsi.

Jorfi, E., Kalbassi, M. R., Sadeghizadeh, M. and Amirinia, C. 2017. Comparison of sperm quality in silver carp (*Hypophthalmichthys molitrix*) during the spawning season. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Jorjani, S., Ghelichi, A. and Ataee, B. 2017. Comparison of omega-3 fatty acids in dorsal and ventral muscle of silver carp (*Hipophthalmichthys* (*sic*) *molitrix*) and big head carp (*Aristichthys nobilis*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 545-552. In Farsi.

Jorjani, S., Ghelichi, A., Hedayati Fard, M. and Roomiani, L. 2015. A survey of chemical and sensory quality changes of fish burgers from common carp (*Cyprinus carpio*) during frozen storage (-18°C). New Technologies in Aquaculture Development (Journal of Fisheries), 8(4):43-56. In Farsi.

Jorjani, S., Ghelichi, A. and Jorjani, H. 2013. A comparison of chemical composition and fatty acids profile of muscle in cultivated cyprinids. Journal of Applied Ichthyological Research, 1(3):85-98. In Farsi.

Jorissen, E. L., Abels, H. A., Wesselingh, F. P., Lazarev, S., Aghayeva, V. and Krijgsman, W. 2020. Amplitude, frequency and drivers of Caspian Sea lake-level variations during the Early Pleistocene and their impact on a protected wave-dominated coastline. Sedimentology, 67(1):649-676.

Jouladeh Roudbar, A. and Eagderi, S. 2017. Study on phylogenetics of *Alburnoides namaki* Bogutskaya and Coad, 2009 using COI gene. Modern Genetics Journal, 11(4):531-538. In Farsi.

Jouladeh Roudbar, A., Eagderi, S. and Esmaeili, H. R. 2015. Fishes of the Dasht-e Kavir basin of Iran: an updated checklist. International Journal of Aquatic Biology, 3(4):263-273.

Jouladeh Roudbar, A., Eagderi, S. and Esmaeili, H. R. 2016. First record of the striped

bystranka, *Alburnoides taeniatus* (Kessler, 1874) from the Hari River basin, Iran (Teleostei: Cyprinidae). Journal of Entomology and Zoology Studies, 4(5):788-791.
Jouladeh Roudbar, A., Eagderi, S., Esmaeili, H. R., Coad, B. W. and Bogutskaya, N. 2016. A molecular approach to the genus *Alburnoides* using COI sequences data set and the description of a new species, *A. damghani*, from the Damghan River system (the Dasht-e Kavir Basin, Iran) (Actinopterygii: Cyprinidae). ZooKeys, 579:157-181.
Jouladeh Roudbar, A., Eagderi, S. and Vatandoust, S. 2017. Comparison of morphology and molecular characteristics of lake and river populations of *Barilius mesopotamicus* in the Tigris basin. Journal of Wetland Ecobiology, 8(4):31-44. In Farsi.
Jouladeh Roudbar, A., Esmaeili, H. R., Gholamifard, A., Zamanian, R. and Vatandoust, S. 2015. Geographic distribution of the genus *Chondrostoma* Agassiz, 1832 in Iran (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 2(2):71-78.
Jouladeh Roudbar, A., Rahimi, H., Vatandoust, S., Najafi, M. and Rahimi, Gh. 2015. A review of morphological character in four described species of *Alburnoides*. Journal of Aquatic Ecology, Hormozgan University, 5(2):1-17. In Farsi.
Jouladeh Roudbar, A., Rahmani, H., Esmaeili, H. R. and Vatandoust, S. 2014a. Morphological variations among *Chondrostoma regium* populations in the Tigris River basin. AACL Bioflux, 7(4):276-285.
Jouladeh Roudbar, A., Rahmani, H., Esmaeili, H. R. and Vatandoust, S. 2014b. Identification of *Chondrostoma regium* with using DNA barcoding method. Animal Science Congress of Iran, Tabriz, 27-28 August 2014, 4 pp. In Farsi.
Jouladeh Roudbar, A., Rahmani, H., Esmaeili, H. R. and Vatandoust, S. 2014c. Identification of *Chondrostoma cyri* with using DNA barcoding method. Animal Science Congress of Iran, Tabriz, 27-28 August 2014, 4 pp. In Farsi.
Jouladeh Roudbar, A. and Vatandoust, S. 2015. The comparative evaluation of morphometric and meristic characters of *Barilius mesopotamicus* (Cypriniformes: Cyprinidae) in Seimareh, Changoleh and Siahgave rivers in Ilam province. Journal of Utilization and Cultivation of Aquatics, 4(1):47-64. In Farsi.
Jouladeh-Roudbar, A. 2014. Morphological and molecular study of the genus *Chondrostoma* Agassiz, 1832 in Iran. Sari University of Agricultural Sciences and Natural Resources, Sari. ix + 76 pp.
Jouladeh-Roudbar, A. 2018. A critique on taxonomic studies on inland water fishes of Iran in the last two decades. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Jouladeh-Roudbar, A. 2021. Analysis of distribution and taxonomy of the *Barbus* Cuvier and Cloquet, 1816 in Iran using *COI* gene. Modern Genetics Journal, 16(2):125-132. In Farsi.
Jouladeh-Roudbar, A. and Eagderi, S. 2019. A re-evaluation of taxonomic status of *Alburnoides parhami* using morphological and genetic data. Modern Genetics, 14(2):101-110. In Farsi.
Jouladeh-Roudbar, A., Eagderi, S., Ghanavi, H. R. and Doadrio, I. 2016. Taxonomic review of the genus *Capoeta* Valenciennes, 1842 (Actinopterygii, Cyprinidae) from central Iran with the description of a new species. FishTaxa, 1(3):166-175.
Jouladeh-Roudbar, A., Eagderi, S., Ghanavi, H. R. and Doadrio, I. 2017. A new species of the genus *Capoeta* Valenciennes, 1842 from the Caspian Sea basin in Iran (Teleostei, Cyprinidae). ZooKeys, 682:137-155.
Jouladeh-Roudbar, A., Eagderi, S., Mobaraki, A. and Rouhani, M. 2016. Morphological

variation of *Barbus lacerta* in different rivers of Kermanshah Province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Jouladeh-Roudbar, A., Eagderi, S., Murillo-Ramos, L., Ghanavi, H. R. and Doadrio, I. 2017. Three new species of algae-scraping cyprinid from Tigris River drainage in Iran (Teleostei: Cyprinidae). FishTaxa, 2(3):134-155.

Jouladeh-Roudbar, A., Eagderi, S. and Soleimani, A. 2016. First record of *Petroleuciscus esfahani* Coad and Bogutskaya, 2010 (Actinopterygii: Cyprinidae) from the Karun River drainage, Persian Gulf basin, Iran. International Journal of Aquatic Biology, 4(6):400-405.

Jouladeh-Roudbar, A., Ghanavi, H. R. and Doadrio, I. 2017. Diversification dynamics within genus *Capoeta* Valenciennes, 1842. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Jouladeh-Roudbar, A., Ghanavi, H. R. and Doadrio, I. 2020. Ichthyofauna from Iranian freshwater: Annotated checklist, diagnosis, taxonomy, distribution and conservation assessment. Zoological Studies, 59:04.

Jouladeh-Roudbar, A., Jafari-Kenari, S. and Eagderi, S. 2016. Fishes of the Hari-Rud (Tajan) basin. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Jouladeh-Roudbar, A., Vatandoust, S., Eagderi, S., Jafari-Kenari, S. and Mousavi-Sabet, H. 2015. Freshwater fishes of Iran; an updated checklist. AACL Bioflux, 8(6):855-909.

Jowkar, H., Ostrowski, S., Tababz, M. and Zahler, P. 2016. The conservation of biodiversity in Iran: threats, challenges and hopes. Iranian Studies, 49(6):1065-1977.

Jozi, S. A., Hoseinie, S. M. and Tabib Shoshtare, M. 2010. Environmental risk assessment of Balaroud Dam of Khuzestan’s construction using analytical hierarchy process. Journal of Marine Sciences and Technology, 5(1):71-88. In Farsi.

Justin, J. B. and Taleghani, K. 1955. Iran develops its rivers. Civil Engineering, 25:49-53 (or 25(3):153-157).

K

Kadkhodaei, M., Nejatkhah, P. and Vousoghi, A. 2015. Investigation of Heptachlor, Heptachlor epoxide and Aldrin in sediments, macrobenthos and caras fish (*Carassius carassius*). Journal of Animal Environment, 7(3):179-188. In Farsi.

Kaffashi, S., Shamsudin, M. N., Radam, A., Yacob, M. R., Rahim, K. A. and Yazid, M. 2012. Economic evaluation and conservation: Do people vote for better preservation of Shadegan International Wetland. Biological Conservation, 150(1):150-158.

Kafilzadeh, F. 2015. Assessment of organochlorine pesticide residues in water, sediments and fish from Lake Tashk, Iran. Achievements in the Life Sciences, 9(2):107-111.

Kafilzadeh, F., Kargar, M. and Kadivar, E. 2007. The study of cadmium, copper, iron and nickel concentration in Khoshk River (Shiraz) and some products of the neigbouring (*sic*). Journal of Environmental Science and Technology, 8(4)(31):67-75. In Farsi.

Kafilzadeh, F., Shiva, A. H., Malekpour, R. and Noorani Azad, H. 2012. Determination of organochlorine pesticide residues in water, sediments and fish from Lake Parishan, Iran. World Journal of Fish and Marine Sciences, 4(2):150-154.

Kafuku, T. 1969. Morphological differentiation of *Cyprinion* in Iraq. Bulletin of the Freshwater

Fisheries Research Laboratory, Tokyo, 19(2):155-159.
Kahkesh, F. B., Yooneszadeh, M., Amiri, F. and Nikpey, M. 2011. Survey of different hormones on final maturation in shirbut (*Barbus grypus* Heckel, 1843). World Journal of Fish and Marine Sciences, 3(6):548-552.
Kahkesh F. B., Yooneszadeh Feshalami M., Amiri F. and Nickpey, M. 2010. Effect of ovaprim, ovatide, HCG, LHRH-A2, LHRHA2+CPE and carp pituitary in Benni (*Barbus sharpeyi*) artificial breeding. Global Veterinaria, 5(4):209-214.
Kahkesh, M. and Roomiani, L. 2018. Effect of dietary *Lactobacillus casei* and different levels of immunogen on the activities of immunological and hematological factors of *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 26(6):139-150. In Farsi.
Kahrom, E. 2000. Wildlife conservation in Iran. Asian Affairs, 31(1):49-56.
Kähsbauer, P. 1957. Viktor Pietschmann. Annalen des Naturhistorischen Museums in Wien, 61:1-3, Tafel 1.
Kähsbauer, P. 1959. Intendant Dr. Franz Steindachner, sein Leben und Werk. Annalen des naturhistorischen Museums in Wien, 63:1-30, Tafel 1.
Kähsbauer, P. 1963. Zur Kenntnis der Ichthyofauna von Iran. Annalen des naturhistorischen Museums in Wien, 66:317-355.
Kähsbauer, P. 1964. Zur Kenntnis der Ichthyofauna von Iran (II. Teil). Annalen des naturhistorischen Museums in Wien, 67:453-475, 1 Taf.
Kakroodi, A. A., Leroy, S. A. G., Kroonenberg, S. B., Lahijani, H. A. K., Alimohammadian, H., Boomer, I. and Goorabi, A. 2015. Late Pleistocene and Holocene sea-level change and coastal paleoenvironment evolution along the Iranian Caspian shore. Marine Geology, 361:111-125.
Kalantari, F., Yeganeh, S. and Ouraji, H. 2020. The effect of dietary kiwi (*Actinidia* sp.) fruit peel powder on growth performance, carcass composition and digestibility in common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 14(2):111-125. In Farsi.
Kalantarian, S.M., Abdoli, A. and Kiabi, B. H. 2017. Species diversity and catch per unit effort (CPUE) of Gobiidae in Salmanshahr, coastal area of the southern Caspian Sea. Iranian Journal of Fisheries Sciences, 16(2):549-556.
Kalbasi, M. and Mousavi, S. F. 1995. Seven-year study of fluctuations in N, P, EC and pH of the Zayandehrud River. WRM '95. Proceedings of the Regional Conference on Water Resources Management, Conference Secretariat, Isfahan University of Technology, Isfahan, p. 151.
Kalbassi, M. R. 2019. Impact of different levels of organic selenium diet in quality indices gonads, reproductive and antioxidant indices of goldfish, *Carassius gibelio* (Bloch, 1782). Journal of Applied Ichthyological Research, 7(1):47-60. In Farsi.
Kalbassi, M. R., Abdollahzadeh, E. and Salari-Joo, H. 2013. A review on aquaculture development in Iran. Ecopersia, 1(2):159-178.
Kalbassi, M. R. and Ebrahimzadeh, S. M. No date. Fundamentals of theoretical and practical aquaculture. Tarbiat Modares Publication, Tehran. 459 pp. In Farsi.
Kalbassi, M. R., Hosseini, S. V. and Tahergorabi, R. 2008. Karyotype analysis in *Schizothorax zarudnyi* from Hamoon Lake, Iran. Turkish Journal of Fisheries and Aquatic Sciences, 8(2):335-340.
Kalbassi, M. R. and Keyvanshokoh, S. 2004. Current status of aquaculture genetics research in Iran. Proceedings of the Seventh Asian Fisheries Forum, 3-4 November 2004, Penang, Malaysia.

Kalbassi, M. R., Lorestani, R. and Aramli, M. S. 2015. Study of testis histology and sperm morphology in the bunnei, *Barbus sharpeyi* (Gunther, 1874) induced by luteinizing hormone -releasing hormone analogue and carp pituitary extract. Aquaculture Research, doi:10.1111/are.12895 (retracted, 48(2):473-480, doi:10.1111/are.13586).

Kalbassi, M. R., Lorestani, R. and Ghafle Maramazi, J. 2013. Analysis of saline activator solution effects on sperm quality indices of *Barbus sharpeyi* by Image J software. Iranian Journal of Fisheries Sciences, 12(2):357-377.

Kalbassi, M. R., Lorestani, R. and Marammazi, J. G. 2014. Improvement of sperm quality indices of benni fish (*Barbus sharpeyi*) by application of $LHRHa_2$ and metoclopramide. Journal of Agricultural Science and Technology, 16(1):91-104.

Kalbassi, M. R., Panahi Sahebi, H. and Nazari, R. M. 2002. Crossbreeding of female grass carp (*Ctenopharyngodon idella*)*male bighead carp (*Hypophthalmichthys molitrix*) and observation on (F1) hybrids. Iranian Journal of Marine Sciences, 1(3):35-44, 76. In Farsi.

Kalkan, E. 2008. Growth and reproduction properties of *Capoeta trutta* (Heckel, 1843) in Karakaya Dam Lake. Turkish Journal of Zoology, 32(1):1-10.

Kalous, L., Bohlen, J., Rylková, K. and Petrtýl, M. 2012. Hidden diversity within the Prussian carp and designation of a neotype for *Carassius gibelio* (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 23(1):11-18.

Kalous, L., Rylková, K., Bohlen, J., Šanda, R. and Petrtýl, M. 2013. New mtDNA data reveal a wide distribution of the Japanese ginbuna *Carassius langsdorfii* in Europe. Journal of Fish Biology, 82(2):703-707.

Kals, J. 2006. Improving the utilization of silver carp (*Hypothalmichthys molitrix*) (*sic*) and other under-utilized fish species, especially fresh water bream (*Abramis brama*) 2005-2006: possibilities for value adding supply chains and international trade of silver carp (*Hypothalmichthys molitrix*) (*sic*) in the Islamic Republic of Iran. Research Report, Netherlands Institute for Fisheries Research, IJmuiden, RIVO C006B/06, 25 pp.

Kals, J. and Bartels, P. V. 2004. Improving utilization of silver carp (*Hypopthalmichthys Molitrix* (*sic*)) and other under-utilized fish species. Fact finding and goal establishing mission to the Islamic Republic of Iran (31 January - 5 February 2004). Wageningen University and Research Centre Report DWK, 404:1-30.

Kalte, S., Alizadeh Doghikolaee, E. and Yousef Elahi, M. 2014. Effect of edible chitosan-gelatin coating on the quality characteristics and shelf life of fish finger of *Hypophthalmichthys molitrix* during refrigerated storage. Journal of Fisheries Science and Technology, 3(1):45-55. In Farsi.

Kalteh, S., Alizadeh Doughikollaee, E. and Yousef Elahi, M. 2015. Effect of edible gelatin coating on the quality of fish finger of *Hypophthalmichthys molitrix* during refrigerated storage. Iranian Journal of Food Science and Technology, 12(48):79-88. In Farsi.

Kamali, M., Alinejad Moaelem, S. and Pour-Ahmadi, N. 2019. Effect of di 2-ethyl hexyl phthalate on some indices of skin mucus in common carp (*Cyprinus carpio*). Journal of Experimental Animal Biology, 8(1):77-88. In Farsi.

Kamali, M., Ghelichi, A. and Mousavi Nadoushan, R. 2014. Diversity, density and frequency of crustacean zooplankton community at warm water fishes ponds at east of Golastan Province, Gonbade Kavous City. Journal of Aquatic Animals and Fisheries, 5(17):81-92. In Farsi.

Kamali, M., Rahimi, A., Ghelichi A. and Mousavi Nadushan, R. 2014a. Abundance and biodiversity of phytoplankton community of warm water fish ponds with new

management system (mix of adult and fingerling at same pond) at east of Golestan Province, Iran. Journal of Fisheries, 8(2):19-28. In Farsi.

Kamali, M., Rahimi, A., Ghelichi A. and Mousavi Nadushan, R. 2014b. Blue-green algae community of warm water fishes at east of Golestan Province, Gonbad-e Kavous City. Breeding and Aquaculture Sciences Quarterly, 1(1):83-100. In Farsi.

Kamali, S., Zarehgashti, G., Nasiri, M., Noghani, F. and Khoshkho, Zh. 2019. Study of amino acids profiles and nutritional values of industrial paste enriched with protein concentrates of silver carp (FPC). Iranian Scientific Fisheries Journal, 27(6):165-170. In Farsi.

Kamali-Far, R., Amiri-Moghaddam, J. and Maniei, F. 2009. Induction of spawning in *Capoeta aculeata* (Valenciennes in Cuv. & Val., 1844) (Teleostei, Cyprinidae), using carp pituitary extract. ABAH Bioflux, 1(1):27-31.

Kamali Najafabad, M., Imanpoor, M. R., Taqizadeh, V. and Alishahi, A. R. 2015. Effect of chitosan diet on growth performance and hematological parameters of kutum (*Rutilus frisii kutum*, Kamenskii, 1901) fingerlings. Journal of Animal Environment, 7(1):41-50. In Farsi.

Kamali Najafabad, M., Imanpoor, M. R., Taqizadeh, V. and Alishahi, A. R. 2016a. Effect of chitosan diet on intestinal histology, body composition and salinity and thermal stress resistance in Caspian kutum (*Rutilus frisii kutum*, Kamenskii 1901) fingerlings. Journal of Marine Sciences and Technology,15(3):35-45. In Farsi.

Kamali Najafabad, M., Imanpoor, M. R., Taqizadeh, V. and Alishahi, A. R. 2016b. Effect of dietary chitosan on growth performance, hematological parameters, intestinal histology and stress resistance of Caspian kutum (*Rutilus frisii kutum* Kamenskii, 1901) fingerlings. Fish Physiology and Biochemistry, 42(4):1063-1071.

Kamali Sabeti, N. 2021. An overview of the characteristics and physiology of benni fish (*Mesopotamichthys sharpeyi*). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 5 pp. In Farsi.

Kamali Sanzighi, M. 2015. Abundance and biodiversity of zooplankton community in integrated fingerling and grower fishes at east of Golestan Province (Gonbad-e Kavous City). Journal of Utilization and Cultivation of Aquatics, 3(4):77-90. In Farsi.

Kamali Sanzighi, M. and Mousavi Nadushan, R. 2015. Evaluation of zooplankton community and saprobi index of carp’s culture ponds (Case study: East of Golestan Province - Gonbad-e Kavous city). Iranian Scientific Fisheries Journal, 24(1):145-154. In Farsi.

Kamali Sanzighi, M., Rahimi, A. and Ghelichi, A. 2016. Ecological indices of diversity, richness, dominance and evenness of zooplankton community at warm water fishes pond at east of Golestan Province (Gonbad-e Kavous City). New Technologies in Aquaculture Development (Journal of Fisheries), 10(2):21-32. In Farsi.

Kamali-Sanzighi, M., Akrami, R., Ghelichi, A. and Shamloofar, M. 2019. Partial replacement of plant sources by waste date (*Phoneix Dactylifera* (*sic*)) in the diet of fingerling carp (*Cyprinus carpio*) on growth performance, feed utilization, hematological parameters and resistance to stress. Turkish Journal of Fisheries and Aquatic Sciences, 19(9):775-784.

Kamaly, A. 1991. Effect of cold weather on the growth of mixed carp species in ponds. Bulletin Zoölogisch Museum Universiteit van Amsterdam, Special Issue, August 1991, Abstracts of Presentations, Seventh International Ichthyology Congress of the European

Ichthyological Union, The Hague, The Netherlands 26-30 August, 1991:35.
Kamari, S. and Shabanpour, R. 2013. Development and sensory evaluation of silver carp (*Hypophthalmichthys molitrix*) fish based snack food. World Journal of Fish and Marine Sciences, 5(6):670-673.
Kamensky, S. N. 1899-1901. Karpovye (Cyprinidae) Kavkaza i Zakavkaz'ya [Die Cypriniden der Kaukasusländer und ihrer angrenzenden Meere]. Tiflis. viii + 157 pp., Taf. I-VI, ii + 192 pp., Taf. VII-XII. In Russian and German.
Kamiar, M. 1983. The qanat system in Iran. Ekistics, 50(303):467-472.
Kamilov, G. 1966. Contributions to the life history of the Turkestan barbel in the reservoirs of the Zarafshan basin. Nauchnye Trudy Tashkent Universiteta, 291:127-134. In Russian.
Kamilov, B. G. 1994. Fecundity of eastern bream, *Abramis brama orientalis* Berg, from reservoirs in southern Uzbekistan. Acta Hydrobiologica, 36(2):245-253.
Kamkar, A., Jebelli Javan, A., Nemati, G., Falahpour, F. and Partovi, R. 2014. Effects of *Mentha pulegium* water extract dipping on quality and shelf life of silver carp (*Hypophthalmichthys molitrix*) during superchilled storage. Iranian Journal of Fisheries Sciences, 13(2):341-353.
Kamran, A. 2006. Survey on bony fish catches in Gorgan Gulf. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).
Kanaani, E., Shabany, A. and Safari, R. 2020. The effects of separate and combined use of sodium propionate salt and probiotic *Pediococcus acidilactici* on some growth factors and the expression of some growth-related genes in common baby carp (*Cyprinus carpio*). Journal of Animal Environment, 12(1):293-298. In Farsi.
Kanani, R., Fakheri Fard, A., Ghorbani, M. A. and Dinpashoh, Y. 2019. Analysis of the role of climatic and human factors in runoff variations (case study: Lighvan River in Urmia Lake Basin, Iran). Journal of Water and Climate Change, 11(1):291-302.
Kanazawa, R. H. 1955. Fishes of Iraq and Iran. American Documentation Institute, ADIM 4612:43-46.
Kapourchali, M. F. 2006. The role of *Brachionus plicatillis* (Rotifers) by increasing survivor of *Rutilus frisii kutum* larvae and its comparison by concentrate food. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bandar Anzali. http://en.ifro.ir (abstract).
Kapoorchali, M. F., Fatemi, S. M. R., Vosoghy, G., Matinfar M. and Sharifian, M. 2009. Increasing in growth of *Rutilus frisii kutum* larvae with using slurry (fermented organic manure) in Yosefpoor Propagation and Rearing Center (Iran). Journal of Fisheries and Aquatic Science, 4(1):22-31.
Karabanov, D. P., Pavlov, D. D., Nikitin, E. V., Solomatin, Yu. I., Kostrykina, T. A., Smirnov, A. K. and Stolbunov, I. A. 2020. Analysis of species composition, problems of identification and dispersal pathways of invasive species of fish in Volga river basin. Vestnik of Astrakhan State Technical University, Series: Fishing Industry. 3:7-17. In Russian).
Karahan, A. and Ergene, S. 2010. Cytogenetic analysis of *Garra variabilis* (Heckel, 1843) (Pisces, Cyprinidae) from Savur Stream (Mardin). Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 10(4):483-489.
Karaman, M. S. 1969a. Süßwasserfische der Türkei. 7. Teil. Revision der kleinasiatischen und vorderasiatischen Arten des Genus *Capoeta* (*Varicorhinus*, Partim). Mitteilungen aus

dem hamburgischen Zoologischen Museum und Institut, 66:17-54.
Karaman, M. S. 1969b. Zwei neue Süßwasserfische aus Afghanistan und Iran. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 66:55-58.
Karaman, M. S. 1971. Süßwasserfische der Türkei. 8. Teil. Revision der Barben Europas, Vorderasiens und Nordafrikas. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 67:175-254.
Karaman, M. S. 1972. Süßwasserfische der Türkei. 9. Revision einiger kleinwüchsiger Cyprinidengattungen *Phoxinellus*, *Leucaspius*, *Acanthobrama* usw. aus Südeuropa, Kleinasiens, Vorder-Asien und Nordafrika. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 69:115-155.
Karami, E., Mesbah, M., Molayem Raftar, T., Mohammadian, T., Hoseini, S. S. and Nazari, M. 2016. Effects of aqueous extract of *Sargassum angustifolium* (Agardh, 1820) on some of the hematological parameters in common carp *Cyprinus carpio* (Linnaeus 1758) (*sic*). Journal of Aquatic Ecology, Hormozgan University, 6(2):124-133. In Farsi.
Karami, E. A., Rezaei Moghadam, K., Ahamdvand, M. and Lari, M. B. 2006. Adoption of rice-fish farming (RFF) in Fars Province. Iranian Agricultural Extension and Education Journal, 2(2):31-43. In Farsi.
Karami, G. H. and Bahmani, M. 2008. Assessing the heavy metal pollution in rivers entering to Maharloo Lake, Iran. Proceedings of Taal 2007: The 12th World Lake Conference, 28 October - 2 November 2007, Jaipur, Rajasthan, pp. 283-285.
Karami, G. H. and Mahmoodi, K. 2008. Evaluating the water quality in rivers entering to Golestan Lake, Iran. Proceedings of Taal 2007: The 12th World Lakes Conference, 28 October-2 November 2007, Jaipur, Rajasthan, pp. 279-282.
Karami, M. 1992. Nature Reserves in the Islamic Republic of Iran. Species, Newsletter of the Species Survival Commission, IUCN, 19:11.
Karami, M., Ebrahimzadeh, M. A. and Masror, Y. 2005. Measurement of ache activity in the brain of sea, well and river-fed *Cyprinus carpio* as a health index. Scientific Journal of Kurdistan University of Medical Sciences, 9(2)(34):13-19. In Farsi.
Karami, M., Kasmani, M. E. and Alamesh. A. A. 2001. Plants of Hashilan Wetland, Kermanshah, Iran. Journal of Sciences, Islamic Republic of Iran, 12(3):201-207.
Karami Nasab, M., Shabani, A., Kolangi Miandare, H. and Sharbaty, S. 2014. Genetic diversity of *Barbus grypus* (Heckel, 1843) in Karoun and Dez rivers in Khuzestan province by using microsatellite marker. Journal of Applied Ichthyological Research, 2(1):63-74. In Farsi.
Karami Rad, N., Jafarian, H., Patimar, R., Farhangi, M. and Abdolhai, H. A. 2021. The Caspian kutum *Rutilus kutum* (Kamensky, 1901) and three decades (70-90) of it's restocking program in the southern Caspian Sea. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 10 pp. In Farsi.
Karami-Motlagh, A., Eskandary, Gh. R., Khodadi, M. and Jaferian, A. 2013. Studies of sperm morphological and some chemical variables of gattan *Barbus xanthopterus* Heckel, 1843 milt. Journal of Applied Ichthyological Research, 1(1):15-28, 2. In Farsi.
Karamouz, M., Kerachian, R., Zahraie, B. and Jafarzadeh, N. 2005. Development of a master plan for river water pollution control: a case study of Karoon-Dez River system. Iran Water Resources Journal, 1(1):12-28.
Karbassi, A., Bidhendi, G. N., Pejman, A. and Bidhendi, M. E. 2010. Environmental impacts of

desalination on the ecology of Lake Urmia. Journal of Great Lakes Research, 36(3):419-424.

Karbassi, A., Maghrebi, M., Noori, R., Lak, R. and Sadrinasab, M. 2020. Investigation of spatiotemporal variation of drought in Iran during the last five decades. Desert, 25(2):213-226.

Karbassi, A., Monavari, M. and Moogouei, R. 2008. Environmental management of aquaculture in the area of Sarab Gerdu. Journal of Environmental Science and Technology, 36(special issue).

Karbassi, A. R., Bassam, S. S. and Ardestani, M. 2013. Flocculation of Cu, Mn, Ni, Pb, and Zn during estuarine mixing (Caspian Sea). International Journal of Environmental Research, 7(4):917-924.

Kardel, F., Mirzapour, F., Omidzahir, S. and Akhoundian, M. 2016. Heavy metal concentrations in gill and liver tissues of *Rutilus kutum* and *Chelon aurata* in the coast of Babolsar, southern Caspian Sea. International Journal of Aquatic Biology, 4(2):81-88.

Kardovani, P. 1995. Iranian marine ecosystem (The Persian Gulf and the Caspian Sea). Ghomes, Tehran. 2 volumes.

Karim Koshteh, M. H., Akbari, A. and Rezazadebahi, M. M. 2000. Economical efficiency of fishery units in Sistan area. The Third World Fisheries Congress, Beijing, 31 Oct - 2 Nov 2000 (title).

Karimi, A., Imanpour, M., Safari, R., Hosseinifar, H. and Jafar, A. 2018. Effects of dietary administration of probiotic *Pediococcus acidilactici* and multi-enzyme apsozyme on growth indices, some biochemical parameters in common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(3):185-190. In Farsi.

Karimi, B., Fattollahi, M., Nemattollahi, A. and Ashouri, G. 2014. Biological response of common carp fingerling (*Cyprinus carpio* Linnaeus, 1758) to complete feeding following short starvation and re-feeding: Daily growth changes, hyperphagia and the body indices. Journal of Applied Ichthyological Research, 2(1):33-50. In Farsi.

Karimi, F., Moattar, F., Farshehi, P., Savari, A. and Parham, H. 2012. ERA: suitable method for estimation of ecological effects of pesticide contamination on aquatic species. Journal of the Persian Gulf, 3(8):67-73.

Karimi, H. and Alimoradi, S. 2011. The effects of the 2007-2008 drought on water resources in Ilam Province, Iran. Hydro-climatology: Variability and Change, Proceedings of Symposium J-HO2, July 2011, Melbourne, pp. 87-92.

Karimi, M., Paknejad, H., Hoseinifar, S. H., Sha'bani, A. and Torfi Mozanzadeh, M. 2020. The effects of dietary raffinose on skin mucus immune parameters and protein profile, serum non-specific immune parameters and immune related genes expression in common carp (*Cyprinus carpio* L.). Aquaculture, 520:734525.

Karimi, M., Paknejad, H., Hosseinifar, S. H. and Shabani, A. 2019. The effects of different levels of raffinose on growth performance and mucosal immune parameters in common carp (*Cyprinus carpio*) fingerlings. Journal of Utilization and Cultivation of Aquatics, 8(1):31-39. In Farsi.

Karimi, N., Mousavi-Sabet, H. and Falahatkar, B. 2021a. The assessment of the relationship between length and weight and somatic condition of *Vimba persa* in the southwestern of the Caspian Sea (Kiashahr port). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Karimi, N., Mousavi-Sabet, H. and Falahatkar, B. 2021b. A review of the distribution and reproductive migration of *Vimba persa*. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Karimi Pashaki, A., Ghasemi, M., ZorriehZahra, J., Sharif Rohani, M. and Hosseini, S. M. 2018. Effects of diets containing aqueous-alcoholic extract of olive leaf (*Olea europaea* L.) on growth performance and some blood and immune parameters in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 27(2):71-80. In Farsi.

Karimi Pashaki, A., Ghasemi, M., Zorriehzahra, M. J., Sharif Rohani, M. and Hosseini, S. M. 2020. Effects of dietary garlic (*Allium sativum*) extract on survival rate, blood and immune parameters changes and disease resistance of common carp (*Cyprinus carpio carpio* Linnaeus, 1758) against spring viremia of carp (SVC). Iranian Journal of Fisheries Sciences, 19(3):1024-1039.

Karimi Pashaki, A., Zorriehzahra, S. M. J., Ghasemi, M., Sharif Rohani, M. and Hosseini, S. M. 2018. Effects of dietary garlic extract on some blood, immunity and growth parameters of common carp fingerlings (*Cyprinus carpio*). Iranian Journal of Aquatic Animal Health, 4(2):28-39.

Karimi Sari, V. and Askary Sary, A. 2014. The study of iron levels and hazard quotient (HQ) on muscle of farmed carp fish from Khuzestan, south west of Iran. International Journal of Biosciences, 5(7):131-136.

Karimian, E., Bahrami Kamangar, B., Mohammadi, H. and Ghaderi, E. 2020. Water quality assessment of the Garan dam reservoir (Marivan) using NSFWQI qualitative index. Journal of Natural Environment (Iranian Journal of Natural Resources), 73(3):571-583. In Farsi.

Karimian, E., Zajeri, M., Vahid Farabi, S. M., Haghi, M. and Kochanian, P. 2017. The impact of rainbow trout culture in floating cage on structure of zooplankton communities in the Abbas Abad area, southern basin of the Caspian Sea. Journal of Aquaculture Development, 11(3):75-94. In Farsi.

Karimian, S., Chamani, A. and Shams, M. 2020. Evaluation of heavy metal pollution in the Zayandeh-Rud River as the only permanent river in the central plateau of Iran. Environmental Monitoring and Assessment, 192(5):316.

Karimpour, M. 1993. Back calculation and growth studies in fishes. Abzeeyan, Tehran, 4(6):22-25, V. In Farsi.

Karimpour, M. 1998. The ichthyofauna of Anzali Lagoon. Iranian Scientific Fisheries Journal, 7(2):83-94, 9. In Farsi.

Karimpour, M., Harlioglu, M. M., Khanipour, A. A., Abdolmalaki, S. and Aksu, Ö. 2013. Present status of fisheries in Iran. Journal of Fisheries Sciences, 7(2):161-177.

Karimpour, M., Hosseinpour, N. and Haghighi, D. 1992. Smaller shemaya in the Anzali Lagoon. Gilan Fisheries Research Publications. 74 pp.

Karimpour, M., Hosseinpour, N. and Haghighi, D. 1993. Biological survey of *Chalcalburnus chalcoides* guldenstadti (*sic*) spawning migration in Anzali Lagoon. Iranian Fisheries Bulletin, (4):39-52, 4. In Farsi.

Karimzadeh, G., Nezhadmoghadam, O. and Gorjian, M. 2014. Effects of environmental and biological conditions on the migration and catch of kutum (*Rutilus frisii kutum* Kamensky) in the southwest region of the Caspian Sea. Breeding and Aquaculture Sciences Quarterly, 2(4):41-54. In Farsi.

Karimzadeh, K. 2018. Anticoagulant effects of glycosaminoglycan extracted from fish scales. International Journal of Basic Science in Medicine, 3(2):72-77. In Farsi.
Karimzadeh, K. and Zahmatkesh, A. 2017. The effect of different dietary zinc on pyruvate kinase activity and electrophoretic pattern of muscle in Caspian kutum (*Rutilus frisii kutum*, Kamensky, 1901). Journal of Aquaculture Development, 11(4):91-103. In Farsi.
Karimzadeh, K., Zahmatkesh, A. and Sharifi, E. 2018. Effect of subacute toxicity nano zinc oxide (ZnO NPs) on oxidative stress enzymes of roach (*Rutilus rutilus caspicus*). Journal of Animal Biology, 10(2):61-70. In Farsi.
Karimzadeh, S., Keramat Amirkolaie, A. and Esmaeili Molla, A. 2013. Effects of different levels of Immunogen on growth performance, intestinal bacteria colonization and survival rate in *Rutilus kutum* larvae. World Journal of Fish and Marine Sciences, 5(6):664-669.
Karimzadeh, S., Mohamad Jafary, A. and Keramat Amirkolaie, A. 2020. The effects of dietary nucleotide type (Hilyses and Augic15) on growth performance and salinity resistance of kutum, *Rutilus kutum* (Kamensky, 1901) fingerlings. Iranian Journal of Fisheries Sciences, 19(3):1140-1152.
Karizaki, V. M, 2016. Ethnic and traditional Iranian rice-based foods, Journal of Ethnic Foods, 3(2):124-134.
Karpevich, A. F. and Lukonina, N. K. 1970. Transplantations of fishes and aquatic invertebrates in 1966. Journal of Ichthyology, 10(3):404-420.
Karpevich, A. F. and Lukonina, N. K. 1971. Transplantations of fishes and aquatic invertebrates in 1967. Journal of Ichthyology, 11(1):98-112.
Karpevich, A. F. and Lukonina, N. K. 1972. Transplantations of fishes and aquatic invertebrates in 1968. Journal of Ichthyology, 12(2):325-341.
Karpinsky, M. G. 1992. Aspects of the Caspian Sea benthic ecosystem. Marine Pollution Bulletin, 24(8):384-389.
Karrer, C., Whitehead, P. J. P. and Paepke, H-J. 1994. BLOCH & SCHNEIDER's Systema Ichthyologiae, 1801: History and authorship of fish names. Mitteilungen aus dem Zoologischen Museum in Berlin, 70(1):99-111.
Kaseb, A. and Kalbassi, M. R. 2015a. Examining the toxicity of colloidal silver nanoparticles in the Caspian Sea white fish (*Rutilus frisii kutum*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 236.
Kaseb, A. and Kalbassi, M. R. 2015b. Effect of colloidal silver nanoparticles on bacterial floral changes skin of Caspian kutum (*Rutilus frisii kutum*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 237.
Kashani, Z. H., Imanpoor, M. R., Shabani, A. and Gorgin, S. 2012a. Effects of dietary vitamin C and E and highly unsaturated fatty acid on biological characteristics of gonad, hatching rate and fertilization success in goldfish (*Carassius auratus Gibelio* (*sic*)). World Journal of Fish and Marine Sciences, 4(2):131-135.
Kashani, Z. H., Imanpoor, M. R., Shabani, A. and Gorgin, S. 2012b. Effect of dietary vitamin C and highly unsaturated fatty acids on some biochemical blood parameters in goldfish (*Carassius auratus gibelio*). World Journal of Fish and Marine Sciences, 4(5):454-457.
Kashani Sabet, A. R., Oryan, Sh. and Bahmani, M. 2004. Ovulation induced in brood fishes of *Hypophthalmichthys molitrix* by using LHRH-A hormone and its combination with dopamine antagonists. Iranian Scientific Fisheries Journal, 13(3):129-144. In Farsi.
Kashefi, P., Bani, A. and Ebrahimi, E. 2012. Morphometric and meristic variations between non-reproductive and reproductive kutum females (*Rutilus frisii kutum*, Kamensky, 1901), in

the southwest Caspian Sea. Italian Journal of Zoology, 79(3):337-343.

Kashefi Alasl, M. and Zaeimdar, M. 2009. The need for Jajrood River quality management. Journal of Environmental Science and Technology, 11(2)(41):119-129. In Farsi.

Kashfi, M. S. 1976. Plate tectonics and structural evolution of the Zagros geosyncline, southwestern Iran. Bulletin of the Geological Society of America, 87(10):1486-1490.

Kashiri, A., Gholipour, H., Patimar, R. and Mazandarani, M. 2018. Effect of pesticide glyphosate on histological lesions of kidney in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 7(1):27-34. In Farsi.

Kashiri, H. 2009. Genetic diversity study *Rutilus rutilus caspius* fish in the southern shores of the Caspian using microsatellite markers. MSc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. In Farsi.

Kashiri, H., Shaabani, A., Shaabanpour, B. and Rezaei, M. 2010. Microsatellite polymorphism in natural populations of threatened Caspian roach in Golestan coasts. Journal of Taxonomy and Biosystematics, 2(2)(3):55-66.

Kashiri, H., Shabani, A., Gorgin, S., Rezaii, M. and Jabale, A. R. 2018. Microsatellite DNA marker analysis of genetic variation in wild and hatchery populations of Caspian kutum (*Rutilus kutum*). Turkish Journal of Fisheries and Aquatic Sciences, 18(9):1101-1111.

Kashiri, H., Shabani, A., Gorgin, S., Rezaii, M. and Jebele, A. R. 2017. Investigating the genetic structure of wild and hatchery populations of kutum *Rutilus kutum* Kamensky, 1901 using ten microsatellite markers. Journal of Applied Ichthyological Research, 5(3):55-70. In Farsi.

Kashiri, H., Shabani, A. and Shabanpoor, B. 2012. Genetic diversity of Caspian roach (*Rutilus rutilus caspicus*) in Gharesou and Gomishan regions using microsatellite. Iranian Journal of Biology, 25(1):139-147. In Farsi.

Kashiri, H., Shabani, A., Shabanpour, B. and Rezaei, M. 2012. Population structure of Caspian roach (*Rutilus rutilus caspicus*) in southern coasts of Caspian Sea using microsatellite markers. Journal of Marine Sciences and Technology, 10(4):4-14. In Farsi.

Kasiri, M., Farahi, A., Sudagar, M. and Mirzakhani, M. K. 2011. The effects of time of reproductive migration on semen spermatological parameters in migrated kutum *Rutilus frisii kutum* to Valiabad River. European Journal of Biological Sciences, 3(2):40-43.

Kask, J. L. 1970. Report to the Government of Iran on general fisheries development. Food and Agriculture Organization, Rome, United Nations Development Programme, Technical Assistance, UNDP (TA) 2887:v + 10 pp.

Kasraei, M. 2001. Study on Acanthocephalans from fishes in Zayandehrud River. M.Sc. Thesis, Isfahan University of Technology, Isfahan. 86 pp.

Kassim, T. I., Salman, N. A., Al-Lami, A., Muften, F. S., Abood, S. M. and Shkaer, H. K. 1998. The use of locally-raised live food and artificial diet for feeding cyprinid larvae in Iraq. Marina Mesopotamica, 13(1):77-90.

Kassler, P. 1973. The structural and geomorphic evolution of the Persian Gulf, pp. 11-32. In: Purser, B. H. (Ed.). The Persian Gulf. Holocene carbonate sedimentation and diagenesis in a shallow epicontinental sea. Springer-Verlag, New York. vi + 471 pp.

Kas'yanov, A. N., Izyumov, Yu. G. and Kas'yanova, N. V. 1995. Growth of roach, *Rutilus rutilus*, in Russia and adjacent countries. Journal of Ichthyology, 35(9):256-272.

Kasymov, A. and Rogers, L. 1996. Ecological description of the southern Caspian Sea in the oil-field region of "Guneshly". Polish Ecological Studies, 22(3-4):83-93.

Kasymov, A. G. 1982. The role of Azov-Black Sea invaders in the productivity of the Caspian

Sea benthos. Internationale Revue der Gesamten Hydrobiologie, 67(4):533-541.

Katunin, D. N. 2000. Transboundary diagnostic analysis of relevantly important commercial bioresources. TACIS (Technical Assistance to the Commonwealth of Independent States, European Union), The Caspian Scientific and Research Institute of Fishery (Kaspnirkh), The Caspian Regional Thematic Center on Fish and other Commercial Bioresources Management (CRTC MB). 49 pp.

Kavan, L. S., Gilkolaei, S. R., Vossoughi, G., Fatemi S. M. R., Safari, R. and Jamili, S. 2009. Population genetic study of *Rutilus frisii kutum* (Kamensky 1901) from the Caspian Sea; Iran and Azerbaijan regions, using microsatellite markers. Journal of Fisheries and Aquatic Science, 4(6):316-322.

Kavian, A., Eslamiprikhani, H. and Habibnejad, M. 2016. Spatial variability of water quality in the Haraz River toward downstream. Iranian Journal of Watershed Management Science, 10(32):77-82. In Farsi.

Kavoosi Kalashami, M., Gharib Parsa, A. and Allahyari, M. S. 2016. Evaluating production characteristics and cost structure of warm water fisheries farm in Guilan Province. Journal of Aquaculture Development, 10(1):117-132. In Farsi.

Kavraiskii, F. F. 1897. Zametki o rybakh Kavkaza. 1. Ukleiki (g. Alburnus) [Notes on fishes of the Caucasus. 1. Bleaks (Genus Alburnus)]. Izvestiya Kavkazskago Muzeya, Tiflis, 1(1):1-18 (Vestnik Rybopromyshlennosti, St. Petersburg, 1896:405-418). Bemerkungen über Kaukasische Fische I. Die Ucklei-Arten (g. Alburnus). Mittheilungen des Kaukasischen Museums, 1(1):1-20.

Kavraiskii, F. F. 1901. Otchet o komandirovke dlya izucheniya r. Kury i ozer Tiflisskoi gubernii i Karskoi oblasti [Report of the Expedition for Exploration of the Kura River and lakes of the Tiflis Province and the Kars Region]. St. Petersburg. 70 pp.

Kawamura, K., Ueda, T., Arai, R. and Smith, C. 2014. Phylogenetic relationships of bitterling fishes (Teleostei: Cypriniformes: Acheilognathinae), inferred from mitochondrial cytochrome *b* sequences. Zoological Science, 31(5):321-329.

Kay, P. A. and Johnson, D. L. 1981. Estimation of Tigris-Euphrates streamflow from regional paleoenvironmental proxy data. Climatic Change, 3(3):251-163.

Kaya, C. 2019. Taxonomic revision of the species belonging to genus *Capoeta* distributed in Turkey. Ph.D. Thesis, Recep Tayyip Erdogan University, Institute of Science and Technology, Rize, Turkey. 126 pp.

Kaya, C. 2020. New record of three freshwater fish species from a western drainage of Lake Urmia for the Turkish fauna. Ege Journal of Fisheries and Aquatic Sciences, 37(4):325-328.

Kaya, C., Bayçelebi, E. and Turan, D. 2020. Taxonomic assessment and distribution of fishes in upper Kura and Aras river drainages. Zoosystematics and Evolution, 96(2):325-344.

Kaya, C., Bayçelebi, E. and Turan, D. 2021. Illustrated type specimens catalogue of Recep Tayyip Erdogan University Zoology Museum of the Faculty of Fisheries. Zootaxa, 4996(3):401-442.

Kaya, C., Turan, D. and Ünlü, E. 2016. The latest status and distribution of fishes in upper Tigris River and two new records for Turkish freshwaters. Turkish Journal of Fisheries and Aquatic Sciences, 16(3):545-562.

Kazancheev, E. N. 1981. Ryby Kaspiiskogo Morya [Fishes of the Caspian Sea]. Legkaya i Pischchevaya Promyshlennost, Moskva. 167 pp. (translation by A. Shariati, Iranian Fisheries Company, 1992).

Kazanskii, V. I. 1915. Materialy po razvitiyu i sistematike lichinok karpovykh ryb [Materials on the development and taxonomy of larval cyprinids]. Trudy Ikhtiologicheskoi Laboratorii, Astrakhan, 3(7):1-23, 5 tables.

Kazanskii, V. I. 1925. Etyudy po morfologii i biologii lichinok ryb nizhnei Volgi [Studies in the morphology and biology of fish larvae of the lower Volga]. Trudy Ikhtiologicheskoi Laboratorii, Astrakhan, 5(3):1-109, 10 tables.

Kazanskii, V. I. 1928. K morfologii i sistematike lichinochnykh stadii karpovykh ryb tipa vobly (*Rutilus rutilus caspicus* Jak.) [On the morphology and taxonomy of the larval cyprinids of the vobla (*Rutilus rutilus caspicus* Jak.) type]. Trudy Ikhtiologicheskoi Laboratorii, Astrakhan, 6(3):1-18, 4 tables.

Kazemi, M. 2009. The effect of different ratios of carbohydrates to dietary fat on growth indicators, nutrition and fish body composition (*Barbus sharpeyi*) young. M. Sc. Thesis in Fisheries, Khorramshahr University of Marine Sciences and Technology, 61 pp. In Farsi.

Kazemi Karaji, F., Abdanan Mehdizadeh, S. and Orak, H. 2019. Study of colour and textural feature variation of carp meat using image processing. Journal of Innovative Food Technologies, 6(2)257-276. In Farsi.

Kazemian, M. and Bakhshi, M. 2020. Performance of different levels of ZnO nanoparticles on the amount of antioxidant enzymes in the liver of koi fish (*Cyprinus carpio*). Journal of Animal Environment, 11(4):243-248. In Farsi.

Kazemian, M., Ramin, M. and Shekari Kashani, M. 2009. Identification and abundance of fish fauna in Qezel Owzan River (Zanjan Province). Journal of Fisheries, 3(3):31-40. In Farsi.

Kazemipour, Y., Rezaei, M. and Keivany, Y. 2005. Qualitative comparison of effects of garlic and mallow and motherwort extracts in healing of superficial wounds in the common carp (*Cyprinus carpio*). Pajouhesh va Sazandegi, 17(1)(66):93-97. In Farsi.

Kazemzadeh, M. and Malekian, A. 2017. Streamflow droughts assessment in Kurdistan Province, Iran. Caspian Journal of Environmental Sciences, 15(4):335-342.

Kazeraani, B. 1994. Barbels of Iran. Abzeeyan, Tehran, 5(1 & 2):24-25, III. In Farsi.

Kazerani, H. R. and Shahsavani, D. 2011. The effect of supplementation of feed with exogenous enzymes on the growth of common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Research, 12(2):127-132.

Kebriti, M., Peyghan, R. and Mohamadian, B. 2011. Evaluation of mortality and histopathological lesions of gills caused by 1 H and 24 H salt bath *Hypophthalmichthys molitrix* fingerling. Journal of Wetland Ecobiology, 2(6):49-56. In Farsi.

Keddie, W. H. 1971. Fish and futility in Iranian development. Journal of Developing Areas, 6(1):9-28.

Keivanloo, S., Sudagar, M. and Mazandarani, M. 2019. Evaluating the suitability of cryopreservation solutions for common carp (*Cyprinus carpio*) embryos stored at -2ºC. Iranian Journal of Fisheries Sciences, 18(4):1036-1045.

Keivany, Y. 2018. Geometric morphometric comparison of *Barilius mesopotamicus* (Berg 1932) populations in Bushehr basin. Journal of Animal Researches (Iranian Journal of Biology), 31(3):286-301. In Farsi.

Keivany, Y. 2019. Comparative biometry of the Urmia bleak populations, *Alburnus atropatenae*. Journal of Animal Researches (Iranian Journal of Biology), 31(4):382-394. In Farsi.

Keivany, Y., Aalipour, M., Khalagy, M., Asaollah, S. and Siami, M. 2017. Parasitic infestation in *Chondrostoma regium* and *Aphanius vladykovi* of the Behest-Abad River

(Chaharmahal-va-Bakhtiary). Iranian Scientific Fisheries Journal, 25(4):101-107. In Farsi.

Keivany, Y., Aalipour, M., Siami, M. and Mortazavi, S. S. 2015. Length-weight relationships for three species from Beheshtabad River, Karun River drainage, Iran. Iranian Journal of Ichthyology, 2(4):296-298.

Keivany, Y. and Arab, M. 2017. Geometric morphometric comparison of trout barb, *Capoeta trutta* (Teleostei: Cyprinidae) in the Tigris River basin, Iranian Journal of Ichthyology, 4(3):220-230.

Keivany, Y., Banimasani, M. and Ebrahimi, E. 2019. Geometric morphometric comparison of teilehkhus fish (*Capoeta capoeta*) in three basins of Iran. Journal of Applied Biology, 32(3):115-128. In Farsi.

Keivany, Y., Dopeikar, H., Ghorbani, M., Kiani, F. and Paykan-Heyrati, F. 2016. Length-weight and length-length relationships of three cyprinid species from the Bibi-Sayyedan River, western Iran. Journal of Applied Ichthyology, 32(3):507-508.

Keivany, Y. and Esmaeili, H. R. 2017. Recent taxonomic changes in freshwater fishes of Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Keivany, Y., Ghorbani, M. and Paykan Heyrati, F. 2017. Age and growth of *Alburnus mossulensis* (Cyprinidae) in Bibi-Sayyedan River of Isfahan Province. Iranian Journal of Fisheries Sciences, 16(4):1164-1177.

Keivany, Y., Ghorbani, M. and Paykan-Heyrati, F. 2017. Reproductive biology of Mossul bleak (*Alburnus mossulensis*) in Bibi-Sayyedan River of Tigris basin in Iran. Caspian Journal of Environmental Sciences, 15(2):135-145.

Keivany, Y. and Ghorbani-Ranjbari, Z. 2017. Geometric morphometric comparison of Mesopotamian minnow (*Barilius mesopotamicus* Berg 1932) populations in Iran. Journal of Utilization and Cultivation of Aquatics, 6(1):1-13. In Farsi.

Keivany, Y. and Mohamadiyani, V. 2015. Gastrosomatic index in *Capoeta aculeata* from Gizehrud River in Noorabad, Lorestan. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 192.

Keivany, Y., Mortazavi, S. S. and Farhadian, O. 2018a. Age and growth of brond-snout (*sic*), *Chondrostoma regium* in Behestabad River of Chaharmahal & Bakhtiari Province of Iran (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 5(1):30-42.

Keivany, Y., Mortazavi, S. S. and Farhadian, O. 2018b. Reproductive biology of king nase in Behestabad River in Chaharmahal and Bakhtiari. Journal of Fisheries Science and Technology, 7(2):135-143. In Farsi.

Keivany, Y., Mousavi, S. M. A., Dorafshan, S. and Zamani-Faradonbe, M. 2016. Morphological variations of *Alburnus mossulensis* Heckel, 1843 populations in the Tigris tributaries of the Persian Gulf basin in Iran (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 3(3):190-202.

Keivany, Y., Mousavi, S. M. A., Dorafshan, S. and Zamani Faradonbeh, M. 2016. Morphological diversity of *Alburnus mossulensis* (Heckel, 1843) populations in Karun River basin. Journal of Applied Ichthyological Research, 4(1):87-104. In Farsi.

Keivany, Y., Nasri, M., Abbasi, K. and Abdoli, A. 2016. Atlas of Inland Water Fishes of Iran. Iran Department of the Environment, Tehran. 216 pp. In Farsi and English.

Keivany, Y., Nasrollahzadeh, G. and Saadati, M. 1990. A preliminary study on the Gorgan-Rud aquatic life - a limnological approach (from Gonbad to Gorgan Dam). A Project

Submitted for the B.Sc. (Eng.) Degree, Gorgan University College of Agriculture and Natural Resources, Gorgan, Iran (English abstract, 2 pp.). In Farsi.

Keivany, Y. and Nasrollahzadeh, G. A. 1990. A report on fishing and fishery industries in Iran. Gorgan University College, Gorgan, Iran. MS, 22 pp. (English abstract, 1 p.). In Farsi.

Keivany, Y., Nezamoleslami, A. and Dorafshan, S. 2015. Morphological diversity of *Garra rufa* (Heckel, 1843) populations in Iran. Iranian Journal of Ichthyology, 2(3):148-154.

Keivany, Y., Nezamoleslami, A., Dorafshan, S. and Eagderi, S. 2015. Length-weight and length-length relationships in populations of *Garra rufa* from different rivers and basins in Iran. International Journal of Aquatic Biology, 3(6):409-413.

Keivany, Y. and Siami, M. 2020. Age and growth of a newly described barb, *Capoeta coadi* (Cyprinidae), in Beheshtabad River, Tigris basin. Annales de Limnologie, 56(1):26, 8 pp.

Keivany, Y., Tahmasebi, A. and Farhadian, O. 2018. Body shape variation of Kura barb (*Barbus* spp.) in Iranian basins. Journal of Experimental Animal Biology, 7(2):97-103. In Farsi.

Keivany, Y. and Zamani-Faradonbe, M. 2016. Length-weight and length-length relationships for six fish species from Zohreh River, Iran. International Journal of Aquatic Biology, 4(6):387-390.

Keivany, Y. and Zamani-Faradonbe, M. 2017a. Length-weight and length-length relationships for seven fish species from the Zohreh River, Iran. Journal of Applied Ichthyology, 33(3):625-627.

Keivany, Y. and Zamani-Faradonbe, M. 2017b. Length-weight and length-length relationships for eight fish species from the Jarrahi River, southwestern Iran. Journal of Applied Ichthyology, 33(4):864-866.

Keivany, Y., Zamani-Faradonbe, M., Mousavi, S.M.A. and Dorafshan, S. 2018. Morphological variations of *Alburnus mossulensis* (Heckel, 1843) populations in Iran. Iranian Journal of Animal Biosystematics, 14(2):73-89.

Keivany, Y. and Zamani-Faradonbeh, M. 2016. Length-weight and length-length relationships for four fish species from Talkhehrud River, Urmia Lake basin, Iran. Journal of Applied Ichthyology, 32(6):1368-1370.

Keivany, Y., Zare, P. and Kalteh, L. 2012. Age, growth and reproduction of the female kutum, *Rutilus kutum* (Kamensky, 1901) (Teleostei: Cyprinidae), in Gorgan-Rud estuary, northern Iran. Research in Zoology, 2(3):7-14.

Kell, V. and Saad, M. A. H. 1975. Untersuchungen über das Phytoplankton und einige Umweltparameter des Shatt al-Arab (Irak). Internationale Revue der Gesamten Hydrobiologie, 60(3):409-421.

Kelts, K. and Shahrabi, M. 1986. Holocene sedimentology of hypersaline Lake Urmia, northwestern Iran. Palaeogeography, Palaeoclimatology and Paleoecology, 54(1-4):105-130.

Kemp, S., Prashad, B., Hora, S. L., Chopra, B. N. and Rao, H. S. 1925. Nelson Annandale 1876-1924. Records of the Indian Museum, 27:1-28, pl. 1. (S. Kemp is assumed to be the author of the obituary on the basis of the initials S. K. at the end of this part of the article; the remaining authors compiled the bibliography).

Kennedy, W. P. 1937. Some additions to the fauna of Iraq. Journal of the Bombay Natural History Society, 39(4):745-749.

Kent, P. E. 1979. The emergent Hormuz salt plugs of southern Iran. Journal of Petroleum Geology, 2(2):117-144.

Keramat Amirkolaie, A. 2015. Effects of prebiotic immunogen on growth performance,

intestinal bacteria colonization, and survival rate in *Rutilus frisii* fry. Caspian Journal of Environmental Sciences, 13(1):99-107.

Keramat Amirkolaie, A., Lashkar Boloky, M. and Mirzaee Abdoli, S. 2010. Effects of pellet and grass diets on growth and morphology of gastro-intestinal tracts in grass carp (*Ctenopharyngodon idella*). Journal of Fisheries (Iranian Journal of Natural Resources), 63(3):209-216. In Farsi.

Keramat Amirkolaie, A. and Rostami, B. 2015. Effects of dietary supplementation with Immunogen® on the growth, hematology and gut microbiota of fingerling common carp *Cyprinus carpio* (Linnaeus). Fisheries and Aquatic Sciences, 18(4):379-385.

Keramati, V., Jamili, S. and Ramin, M. 2010. Effect of diazinon on catalase antioxidant enzyme activity in liver tissue of *Rutilus rutilus*. Journal of Fisheries and Aquatic Science, 5(5):368-376.

Kesharvarz-Shal, F. and Noorhosseini, S. A. 2015. Prioritize of affecting factors on non-adoption of fish farming in rice fields in Guilan Province. Journal of Aquaculture Development, 9(4):53-64. In Farsi.

Keshavarzi, A. R. and Nabavi, S. H. 2006. Dominant discharge in the Kor River, Fars Province, Iran. Tenth International Water Technology Conference, IWTC10 2006, Alexandria, Egypt, pp. 299-306.

Kessler, K. F. 1870. Opisanie novago vida ryb iz semeistva karpo vykh, Cyprinoidei [Description of a new fish species from the Family Cyprinoidei]. Trudy Sankt-Peterburgskago Obshchestva Estestvoispytatelei, 1(1):320-323, pl. III.

Kessler, K. F. 1872. Ikhtiologicheskaya fauna Turkestana [Ichthyological fauna of Turkestan]. Izvestiya Obshchestva Lyubitelei Estestvoznaniya, Antropologii i Etnografii, Moskva, 10(1):47-79, pls. VI-XII.

Kessler, K. 1874a. Opisanie ryb, prinadlezhashchikh k semeistvam, obshchim Chernomu i Kaspiiskomu moryam [Fishes of the Black and Caspian Seas compared and described]. Trudy Sankt-Peterburgskogo Obshchestva Estestvoispytatelei, 5:191-320, 1 pl.

Kessler, K. F. 1874b. Puteshestvie A. P. Fedchenko v Turkestan. Ryby [A. P. Fedchenko's Travel to Turkestan. Fishes]. Izvestiya Obshchestva Lyubitelei Estestvoznaniya, Antropologii i Etnografii, Moskva, 11(3):1-63, pls. I-VIII.

Kessler, K. F. 1877. Ryby, vodyashchiesya i vstrechayushchiesya v Aralo-kaspiisko-pontiiskoi ikhtiologicheskoi oblasti [Fishes of the Aral-Caspian-Pontic Ichthyological Region]. Trudy Aralo-kaspiiskoi ekspeditsii, Sankt- Peterburg, 4:1-360, pls. I-VIII.

Ketmaier, V., Bianco, P. G. and Durand, J.-D. 2008. Molecular systematics, phylogeny and biogeography of roaches (*Rutilus*, Teleostei, Cyprinidae). Molecular Phylogenetics and Evolution, 49(1):362-367.

Keyhani Seyyed, H. R., Hosseinifard Seyyed, M. and Ghasemnezhad, H. 2013. The effect of lam (*Pterocarya fraxinifolia*) watery, methanolic, ethanolic extract and essence, as anesthetics material on the common carp (*Cyprinus carpio*). Breeding and Aquaculture Sciences Quarterly, 1(2):71-78. In Farsi.

Keykha, S., Gharaei, A., Mirdar HarijaNi, J., Ghaffari, M. and Rahdari, A. 2015. Antifungal effects of metalonic sumac (*Rhus coriaria* L.) essential oil on *Schizothorax zarudnyi* eggs. Journal of Veterinary Research, 70(2):131-137. In Farsi.

Keykhosravi, A. R., Atabati, A., Vatandoust, J., Shams, H., Jalili, M. and Rooki, H. 2010. The effect of sublethal concentrations of cadmium on some biochemical parameters in the

blood of silver carp (*Hypophthalmichthys molitrix*). Journal of Oceanography, 1(2):11-16. In Farsi.

Keyserling, E. 1861. Neue Cypriniden aus Persien. Zeitschrift für die Gesammten Naturwissenschaften, Halle, 17(1):1-24, Taf. I-IX.

Keyserling, E. 1863. Neue Cypriniden.... Nouveaux cyprinides de la Perse. Revue et Magazine de Zoologie Pure et Appliquée, 11:419-422. (In French without plates).

Keyvan, A., Moini, S., Ghaemi, N., Haghdoost, A. A., Jalili, S. and Pourkabir, M. 2008. Effect of frozen storage time on the lipid deterioration and protein denaturation during Caspian Sea white fish (*Rutilus frisii kutum*). Journal of Fisheries and Aquatic Sciences, 3(6):404-409.

Keyvanloo, S., Sodagar, M. and Mazandarani, M. 2017. Toxicity of some permeable and non-permeable cryoprotectants on common carp (*Cyprinus carpio*) embryos. Iranian Scientific Fisheries Journal, 26(2):89-99. In Farsi.

Keyvanshokooh, S., Ghasemi, A., Shahriari-Moghadam, M., Nazari, R. M. and Rahimpour, M. 2007. Genetic analysis of *Rutilus rutilus caspicus* (Jakowlew 1870) populations in Iran by microsatellite markers. Aquaculture Research, 38(9):953-956.

Keyvanshokooh, S. and Kalbassi, M. R. 2006. Genetic variation of *Rutilus rutilus caspicus* (Jakowlew 1870) populations in Iran based on random amplified polymorphic DNA markers: a preliminary study. Aquaculture Research, 37(14):1437-1440.

Keyvanshokooh, S. and Kalbassi, M. R. 2009. Genetic variation of Caspian roach (*Rutilus rutilus caspicus*) populations in Iran by using RAPD markers. Modern Genetics Journal, 4(1):41-46. In Farsi.

Khabazian Zadeh, A., Dadolahi Sohrab, A., Alishahi, M., Khazaei, S. H. and Asgari, H. M. 2015. Effect of herbicide atrazine chronic toxicity on bioaccumulation process in fillet of *Barbus grypus*. Iranian Scientific Fisheries Journal, 23(3):21-30. In Farsi.

Khabazian Zadeh, A., Dadolahi Sohrab, A., Alishahi, M., Khazaei, S. H. and Asgari, H. M. 2016. Evaluation of acute and sub-lethal toxicity of herbicide, atrazine, on hematological parameters of *Tor grypus*. Journal of Veterinary Research, 71(3):295-301. In Farsi.

Khadjeh, G., Mesbah, M., Nikmehr, S. and Sabzevarizadeh, M. 2010. Effect of sex on the hematological parameters of reared shirboat (*sic*) fish (*Barbus grypus*). Journal of Veterinary Research, 65(3):217-224. In Farsi.

Khadjeh, G. H., Mesbah, M. and Peyghan, R. 2007. A comparative study on some serum biochemical parameters in culturing benni (*Barbus sharpeyi*) and grass carp (*Ctenopharyngodon idella*). Iranian Veterinary Journal, 3(4):14-23. In Farsi.

Khaefi, R. and Esmaeili, H. 2014. The phylogenetic analysis of the genus *Barbus* Cuvier and Cloquet, 1816 (Actinopterygii: Cyprinidae) using cytb gene sequence. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Khaefi, R. and Esmaeili, H. R. 2015. The distribution map of the *Barbus lacerta* complex group in inland waters of Iran (Teleostei: Cyprinidae). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 131.

Khaefi, R., Esmaeili, H. R. and Amini Chermahini, M. 2017. Natural hybridization of *Luciobarbus barbulus* X *Luciobarbus kersin* and *Luciobarbus barbulus* X *Luciobarbus xanthopterus* in the Persian Gulf basin. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Khaefi, R., Esmaeili, H. R. and Amini Chermahini, M. 2018. Natural hybridization of *Luciobarbus barbulus* x *Luciobarbus kersin* and *Luciobarbus barbulus* x *Luciobarbus xanthopterus* in the Persian Gulf basin. Turkish Journal of Fisheries and Aquatic Sciences, 18(12):1399-1407.

Khaefi, R., Esmaeili, H. R., Ansari, M. H. and Ebrahimi, M. 2018. Genetic diversification and population structure of *Barbus cyri* De Filippi, 1865 (Teleostei: Cyprinidae) in northern Iran inferred from the mitochondrial D-loop gene sequence. Environmental Biology of Fishes, 101(1):181-192.

Khaefi, R., Esmaeili, H. R., Geiger, M. F. and Eagderi, S. 2017. Taxonomic review of the cryptic *Barbus lacerta* species group with description of a new species (Teleostei: Cyprinidae). FishTaxa, 2(2):90-115.

Khaefi, R., Esmaeili, H. R., Sayyadzadeh, G., Geiger, M. F. and Freyhof, J. 2016. *Squalius namak*, a new chub from Lake Namak basin in Iran (Teleostei: Cyprinidae). Zootaxa, 4169(1):145-159.

Khaefi, R., Tahami, M. S., Sayyadzadeh, G. and Esmaeili, H. R. 2013. Morphological study of different populations of an exotic fish (Cyprinidae: *Carassius* sp.) in Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 38 (abstract).

Khaefi, R., Teimori, A. and Esmaeili, H. R. 2017. Phylogenetic relationships and taxonomy of *Luciobarbus barbulus* (Heckel, 1847) (Teleostei: Cyprinidae). Journal of Ichthyology, 57(6):835-845.

Khaefi, R., Vatandoust, S. and Esmaeil (*sic*), H. R. 2017. Re-description of *Barbus miliaris* De Filippi, 1863 (Teleostei: Cyprinidae) from the endorheic Namak Lake basin of Iran. FishTaxa, 2(1):33-42.

Khairkhah, A. 1994. Seafood consumption in Rasht. Abzeeyan, Tehran, 5(3 & 4):23, IV. In Farsi.

Khajavi, S., Zakipour Rahimabadi, E., Ghaffari Moghaddam, M., Shahraki, H., Mir, L. and Zand Karimi, M. 2016. The effects of hydrolysis condition on the antioxidant activity of protein hydrolysate from *Schizothorax zarudnyi*'s waste. Journal of Fisheries (Iranian Journal of Natural Resources), 69(3):351-358. In Farsi.

Khajeh, Gh. H., Peyghan, R., Mesbah, M. and Rasekh, A. A. R. 2008. A comparative study on haematological parameters of culturing benni (*Barbus sharpeyi*) and grass carp (*Ctenopharyngodon idella*). Iranian Veterinary Journal, 4(1)(18):24-36. In Farsi.

Khajeh, M. and Alaghi, K. H. 1998. A study of age, growth and reproduction of roach, *Rutilus rutilus caspicus*, in Gomishan Wetland. B.Sc. Project, University of Gorgan, Gorgan. In Farsi.

Khajehpanah, A., Malekzehi, H., Mehraban, H., Elmi, A., Pazira, A. and Esmaeili, H. R. 2015. Fishes of the Mashkid and Makran basins of Iran: an updated checklist and ichthyogeography. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 143-144.

Khajehpour-Khouei, B. 2000. Survey of Iran's economic interests in the Caspian, pp. 75-86. In: Amirahmadi, H. (Ed.). The Caspian Region at a Crossroad. Challenges of a New Frontier of Energy and Development. St. Martin's Press, New York. xii + 299 pp.

Khajepour, F., Hosseini, S. A. and Imanpour, M. R. 2012. Dietary crude protein, citric acid and microbial phytase and their interacts to influence growth performance, muscle proximate composition and hematocrite of common carp, *Cyprinus carpio* L, juveniles. World

Journal of Zoology, 7(2):118-122.
Khaksary Mahabady, M., Morovvati, H. and Arefi, A. 2014. Anatomical and histological study of gill in *Barbus grypus*. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Khaksary Mahabady, M., Morovvati, H., Arefi, A. and Karamifar, M. 2012. Anatomical and histomorphological study of spleen and pancreas in berzem (*Barbus pectoralis*). World Journal of Fish and Marine Sciences, 4(3):263-267.
Khaksary Mahabady, M., Morovvati, H. and Fakori Hajiyar, R. 2015. Anatomical and histological study of excretory portion of kidney *Arabibarbus grypus*. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 19.
KhakaShour, A. and Kalbassi, M., R. 2015a. Evaluate the effects of different levels of organic selenium diet on sperm quality parameters of goldfish (*Carassius auratus*) using software CASA. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 230.
KhakaShour, A. and Kalbassi, M. R. 2015b. Assess the impact of different levels of dietary organic selenium on sperm DNA quality goldfish (*Carassius auratus*) using alkaline comet assay test. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 231.
Khaksary Mahabady, M., Morovvati, H. and Shahbazi, S. 2017a. Anatomical and histomorphometrical study of hematopoietic portion of kidney in *Barbus pectoralis* (Berzem). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 398-401. In Farsi.
Khaksary Mahabady, M., Morovvati, H. and Shahbazi, S. 2017b. Histological study of excretory portion of kidney in *Barbus pectoralis*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 402-405. In Farsi.
Khakzand, M., Faizi, M. and Azari, A. 2013. A trivalent approach to the quality of the "*Khoshk River*" landscape in Shiraz. Space Ontology International Journal, 1(1):77-85.
Khalaf, A. N., Al-Jafery, A., Allouse, S. B. and Sadek, S. E. 1986. Observations on the age and growth of Chondrostoma regius (*sic*) (Heckel) in Diyala River. Journal of Biological Sciences Research, Baghdad, 17(2):83-98.
Khalaf, A. N., Al-Jafery, A. R., Khalid, B. Y., Elias, S. S. and Ishaq, M. W. 1985. The patterns of accumulation of some heavy metals in Barbus grypus (Heckel) from a polluted river. Journal of Biological Sciences Research, Baghdad, 16(2):51-75.
Khalaf, A. N., Mansoor, K. Y., Al-Jafery, A. R., Allouse, S. B., Penaz, M. and Sadek, S. E. 1988. Growth pattern of the <u>Barbus</u> <u>luteus</u> population inhabiting a flooded Iraqi gravelpit near Al-Nibaey. Journal of Biological Sciences Research, Baghdad, 19(3):681-692.
Khalaf, A. N., Shafi, M., Islam, A. K. M. S., Al-Jafery, A. R. and Sadek, S. E. 1984. Age and growth of *Barbus grypus* Heckel from a polluted river. Environmental Pollution (Series A), 35(1):83-95.
Khalaf, G. 1985. Etude de quelques aspects du régime alimentaire de *Capoeta damascina* (Cyprinidae) dans les cours d'eau libanais. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 22(4):2631-2635.
Khalaf, G. 1987. Le cycle sexuel de *Capoeta damascina* (Cyprinidae) dans les cours d'eau libanais. Cybium, 11(4):395-401.
Khalaf, G., Kraïem, M. M. and Nakhlé, K. 2002. Dynamique de populations de *Capoeta*

damascina (poisson, Cyprinidae) dans un cours d'eau Libanais. Lebanese Science Journal, 3(1):17-26.

Khalaf, K. T. 1961. The marine and freshwater fishes of Iraq. Ar-Rabitta Press, Baghdad. 164 pp.

Khalafian, M., Peyghan, R. and Razi Jalali, M. H. 2010. Study on the parasitic infestation on the following fish species in Ahvaz. Journal of Wetland Ecobiology, 2(3):80-90. In Farsi.

Khalafiyan, M., Akhlaghi, M., Sharifiyazdi, H. and Alishahi, M. 2017. Evaluation of virulence genes (aerolysin, elastase, lipase) in the pathogenesis of *Aeromonas hydrophila* in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(4):397-406. In Farsi.

Khalaji, M., Ebrahimi, E., Motaghe, E., Asadola, S. and Hashemenejad, H. 2017. Water quality assessment of the Zayandehroud Lake using WQI Index. Iranian Scientific Fisheries Journal, 25(5):61-63. In Farsi.

Khalaji, M., Sarkhosh, J., Zangeneh, M. and Amini, Sh. 2015. Morphology of *Chondrostoma regium* (Teleostei: Cyprinidae) in the Sefid-barg River of Kermanshah. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 28.

Khalaji-Pirbalouty, V., Fatemi, Y., Malek-Hosseini, M. J. and Kuntner, M. 2018. A new species of *Stenasellus* Dollfus, 1897 from Iran, with a key to the western Asian species (Crustacea, Isopoda, Stenasellidae). ZooKeys, 766:39-50.

Khalaji-Pirbalouty, V. and Sari, A. 2004. Biogeography of amphipods (Crustacea: Amphipoda: Gammaridae) from the central Zagros Mountains, Iran, with descriptions of two new species. Journal of Natural History, 38(19):2425-2445.

Khaleghi, S. R., Hedayati, S. A., Kashiri, H., Paknejad, H. and Hosseinifar, S. H. 2018. Evaluation of dietary supplements of *Pediococcus acidilactici* bacteria and *Agaricus bisporus* mushroom powder on skin mucus immune indices of common carp (*Cyprinus carpio*) exposed to silver nano-particles. Iranian Scientific Fisheries Journal, 27(3):97-109. In Farsi.

Khaleghizadeh, A. and Sehhatisabet, M. E. 2006. Contribution to the knowledge of the diet of Iranian birds. Ekologia, 15(1-2):145-150.

Khalili, K., Ahmadi, F., Dinpashoh, Y. and Fakheri Fard, A. 2013. Determination of climate changes on streamflow process in the west of Lake Urmia with used to trend and stationarity analysis. International Journal of Advanced Biological and Biomedical Research, 1(10):1220-1235.

Khalili, K. J. and Amirkolaie, A. K. 2010. Comparison of carp (*Cyprinus carpio* L.) morphological and electrophoretic characteristics in the southern coast of the Caspian Sea. Journal of Fisheries and Aquatic Sciences 5(3):200-207.

Khalili, M. 2015. Gill histopathological evaluation of goldfish exposed to sublethal concentrations of ZnO nanoparticles. Journal of Utilization and Cultivation of Aquatics, 4(2):53-62. In Farsi.

Khalili, S. M. 1994. A study of causes and the prevention of pollution in the Caspian Sea. Bandar va Darya, Tehran, 49-50:26-28. In Farsi.

Khalyani, A. H., Mayer, A. L. and Norman, E. S. 2014. Water flows toward power: socioecological degradation of Lake Urmia, Iran. Society and Natural Resources: An International Journal, 27(7):759-767.

Khamees, N. R., Ali, A., Adday, T., Abed, J. M. and A-Tameemi, R. 2019. Fishes of Shatt al-

Arab river. Aquatic Atlas for Shatt Al-Arab River - Southern Iraq. MS, 47 pp. In Arabic.
Khammar, R., Gharae, A., Ghaffari, M. and Rahdari, A. 2016. Effect of various levels of dietary protein on bioenergetics' parameters of snow trout (*Schizothorax zarudnyi*) juveniles. Journal of Oceanography, 6(22):11-18. In Farsi.
Khammar, S. and Karamzahi, E. 2015. Assessment of heavy metals in sediment and tissues of Gara fish from the City of Khash, South East of Iran. Journal of Novel Applied Sciences, 4(3):385-389.
Khan, A. A. 1988. Food and feeding habits of a freshwater carp, *Cyprinion macrostomus* (Heckel) from Sulaimaniyah, Iraq. Indian Journal of Fisheries, 35(4):323-326.
Khan, A. A., Scott, D. A. and Smart, M. 1992. Wetlands of the Seistan Basin, South Caspian and Fars, Islamic Republic of Iran. Ramsar Convention Monitoring Procedure, Ramsar Convention Bureau, Gland, Report No. 26:37 pp., 1 table, 3 figures, 6 appendices.
Khan, M. H. 1934. Habits and habitats of food fishes of the Punjab. Journal of the Bombay Natural History Society, 37(3):655-668.
Khancheh-Sepehrredin, K. 2000. Survey on *Diplostomum spathaceum* in warm water fish cultured and natural water resources in Sanandaj-Kurdistan. DVM Thesis, Urmia Islamic Azad University, No. 394. In Farsi.
Khandan Barani, H. and Dahmardeh, H. A. 2015. The ability of liver and gill tissue recovery after damage caused by the sub lethal concentration of ammonia in common carp (*Cyprinus carpio*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 39.
Khandan Barani, H., Dahmardeh, H. A. and Heidari, M. R. 2016. Effect of different recovery times on some indicators of metabolic enzymes in liver and gill tissue and blood biochemical factors in common carp (*Cyprinus carpio*) as a result of the sub lethal concentration of ammonia. New Technologies in Aquaculture Development (Journal of Fisheries), 10(1):43-54. In Farsi.
Khandan Barani, H., Dahmardeh, H., Miri, M. and Rigi, M. 2019. The effects of feeding rates on growth performance, feed conversion efficiency and body composition of juvenile snow trout, *Schizothorax zarudnyi*. Iranian Journal of Fisheries Sciences, 18(3):507-516.
Khandan Barani, H., Gharaei, A., Sanchooli, N. and Miri, M. 2019. Blood biochemistry fluctuations as influenced by feed provision in juvenile snow trout (*Schizothorax zarudnyi*). Iranian Journal of Fisheries Sciences, 18(4):735-744.
Khandan Barani, H. and Heydari, M. R. 2018. The effects of stocking density on some blood and serum biochemical indices of goldfish *Carassius auratus*. Journal of Experimental Animal Biology, 6(4):87-96. In Farsi.
Khandan Barani, H. and Miri, M. 2017. Changes in metabolic enzymes levels exposed to zinc and cadmium in the snow trout (*Schizothorax zarudnyi*). Journal of Aquatic Ecology, Hormozgan University, 6(4):39-51. In Farsi.
Khandan Barani, H., Miri, M. J. and Dahmardeh, H. A. 2016. Effects of lead (heavy metal) on profile enzyme in some tissues and selection of acceptable indices of snow trout (*Schizothorax zarudnyi*). Journal of Experimental Animal Biology, 4(3):1-11. In Farsi.
Khandan Barani, H., Rahdari, A. and Sanchooli, N. 2016. Effect of dietary nucleotides on some growth parameters, carcass composition and some stress indices in snow trout (*Schizothorax zarudnyi*). Journal of Veterinary Research, 71(2):145-152. In Farsi.
Khanghah, A. P. 2010. The effect of *Ligula intestinalis* on blood sex steroid hormones, gonadal tissue and some other biological parameters changes of *Chalcalburnus mossulensis* in

Vahdat dam of Kordestan-Iran. Ph.D. Thesis, Islamic Azad University, Science and Research Branch, Tehran. 75 pp. In Farsi.

Khani, M., Soltani, M., Shamsaie Mehrjan, M., Foroudi, F. and Ghaeni, M. 2017. The effect of *Chlorella vulgaris* (Chlorophyta, Volvocales) microalga on some hematological and immune system parameters of koi carp (*Cyprinus carpio*). Iranian Journal of Ichthyology, 4(1):62-68.

Khanipour, A. 2016. Study the added value and acceptance of fish patty produced by FPC of *Abramis brama.* Iranian Fisheries Science Research Institute, Tehran. 68 pp. In Farsi.

Khanipour, A., Ahmadi, M., Zareh Gashti, G., Seyfzadeh, M. and Rafipour, F. 2017. Study on bioaccumulation of heavy metals (Cu, Ni, Co, Cr) in edible muscle tissue of crucian carp (*Carassius auratus*) from international wetland of Anzali. Journal of Aquatic Ecology, Hormozgan University, 6(4):91-99. In Farsi.

Khanipour, A. A. 2009. Research on determining of mesh size standard for beach seine fishery cooperatives to boost sustainable bony-fish fishery in southern Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 84 pp. In Farsi.

Khanipour, A. A., Ahmadi, M., Seifzadeh, M., Zareh Gashti, Gh. and Zolfinezhad, K. 2015. Evaluation of bioaccumulation of heavy metals (cadmium, lead and zinc) in edible muscle tissue of crucian carp (*Carassius auratus*) from International Wetland of Anzali. Iranian Journal of Food Science and Technology, 13(54):155-163. In Farsi

Khanipour, A. A., Fathi, S., Fahim Dejban, Y. and Zareh Gashti, Gh. 2013. Chemical indicators for spoilage and shelf-life of the consolidated burgers (kilka-silver carp) during cold storage at -18°C. Iranian Scientific Fisheries Journal, 22(3):41-48. In Farsi.

Khanipour, A. A., Seifzadeh, M., Ahamdi, M. and Zare Gashti, Gh. 2016a. Cadmium and lead accumulation in edible tissues of common carp (*Cyprinus carpio*) fish caught from the International Anzali Lagoon, New Technologies in Aquaculture Development (Journal of Fisheries), 9(4):19-26. In Farsi.

Khanipour, A. A., Seifzadeh, M., Ahamdi, M. and Zare Gashti, Gh. 2016b. Evaluation of chorom (*sic*, chromium), zinc and copper concentrations in edible tissues of carp fish caught in Anzali International Wetland. Journal of Food Technology and Nutrition, 13(3):99-105. In Farsi.

Khanipour, A. A., Seifzadeh, M. and Lakzaei, F. 2015. Determination of nickel and cobalt accumulation in edible tissues of common carp (*Cyprinus carpio*) of the Anzali Wetland. Iranian Scientific Fisheries Journal, 24(2):151-156. In Farsi.

Khanipour, A. A., Seifzadeh, M., Zareh Gashti, Sh. and Ahmadi, M. 2017. Study benzo(ghi)perylane, diben(ah)anthracene, indeno(123cd)pryrene, benzo(a)pyrene hydrocarbons in economic fish wetland. New Technologies in Aquaculture Development (Journal of Fisheries), 11(2):73-82. In Farsi.

Khanipour, A. A. and Valipour, A. R. 2009. Kutum, Jewel of the Caspian Sea. Fisheries Iran, Tehran. 84 pp.

Khan Zamani Mohammadi, M., Hedayatifard, M. and Ghalichi, A. 2014. Surveying of biochemical composition, fatty acid profiles and fillet energy of cultured bighead carp (*Hypophthalmichthys nobilis*) in Mazandaran Province, Iran. Breeding and Aquaculture Sciences Quarterly, 1(1):33-40. In Farsi.

Khanmohammadi Otaghsara, O., Jamili, Sh., Alipour, M. and Ghobadi, Sh. 2020. Evaluation of probiotic properties and the antibacterial activity of lactic acid bacteria isolated from *Rutilus kutum* intestine. Iranian Journal of Fisheries Sciences, 19(6):3086-3097.

Khara, H. 1994. The Protected Region of Siah-Kesheem. Abzeeyan, Tehran, 5(3 & 4):10-17, III. In Farsi.

Khara, H. 2006. Survey of exist specifications morphometric, meristic and inter species molecular genetic on bream (*Abramis brama orientalis*) in Anzali wetland, south coast of Caspian Sea, Aras Dam Lake and Azerbaijan Republic. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 230 pp. In Farsi.

Khara, H. 2018. Effects of different amounts of hydroalcoholic extract of eucalyptus on the blood parameters of grass carp (*Ctenopharyngodon idella*) infected with *Aeromonas hydrophila*. Journal of Animal Researches (Iranian Journal of Biology), 31(1):16-27. In Farsi.

Khara, H., Alijanpour, N., Fallah Shamsi, S. Z., Amiri, K., Mousavi, S. H., Rahbar, M. and Ahmadnezhad, M. 2012. Influence of temperature and migration time on efficiency of artificial reproduction in female kutum (*Rutilus frisii kutum*, Kamenskii 1901) immigrant to the Shiroud River. Journal of Biology Science, 5(4)(series no. 19, 2nd volume):77-84. In Farsi.

Khara, H., Alijanpour, N., Fallah Shamsi, S. Z., Mousavi, S. H., Rahbar, M. and Ahmad Nejad, M. 2011. Effect of female age, length and weight on artificial propagation efficiency in kutum broods (*Rutilus frisii kutum*, Kamenskii 1901) migrating to the Shiroud River. Journal of Fisheries, 4(4):49-56. In Farsi.

Khara, H., Alijanpour, N., Fallah Shamsi, S. Z., Sattari, M., Amiri, K., Rahbar, M. and Ahmadnezhad, M. 2012. Effects of water temperature and migration time on some fecundity indices and fertilization rate of female kutum, *Rutilus frisii kutum*, migratory to Shiroud River in the southwest Caspian Sea. Caspian Journal of Environmental Sciences, 10(1):9-14.

Khara, H., Baradaran Noveiri, S., Dadras, H., Rahbar, M., Ahmadnejad, M. and Khodadoost, A. 2014. Effect of different activation solutions on motility and fertilizing ability of spermatozoa in common carp *Cyprinus carpio* Linnaeus, 1758. Indian Journal of Fisheries, 61(3):63-68.

Khara, H., Baradaran Noveiri, S., Dadras, H., Rahbar, M., Ahmadnezhad, M. and Khodadoust, A. 2013. Sperm motility and fertilizing ability in *Aristichthys nobilis*: effect of ions. Comparative Clinical Pathology, 22(6):1069-1074.

Khara, H., Baradaran Noveiri, Sh., Dadras, H., Rahbar, M., Ahmadnezhad, M., Alinaia, M. and Khodadost, A. 2012. Effect of some ions on sperm activity and artificial propagation performance in *Cyprinus carpio*. Journal of Utilization and Cultivation of Aquatics, 1(3):45-64. In Farsi.

Khara, H., Baradaran Noveiri, Sh., Dadras, H., Rahbar, M., Ahmadnezhad, M. and Khodadoust, A. 2012. The effect of some ions on sperm motility performance and efficiency of artificial propagation of bighead carp (*Aristichthys nobilis*). The First National Conference on Fisheries and Aquaculture, Iran-Bandar Abbas, December 2102.

Khara, H., Baradaran Noveyri, Sh., Dadras, H., Rahbar, M., Ahmadnezhad, M. and Khodadoust, A. 2012. The effect of some ions on sperm motility performance and efficiency of artificial propagation of bighead carp (*Aristichthys nobilis*). Journal of Aquatic Animals and Fisheries, 3(9):31-41. In Farsi.

Khara, H., Baradaran Shahrooz, N., Hadiseh, D., Rahbar, M., Ahmadnejad, A. and Khodadoost, A. 2012. The effect of cations on sperm motility performance and fertilizing ability of silver carp *Hypophtalmychtis* (*sic*) *molitrix*. Acta Veterinaria (Beograd), 62(5-6):599-609.

Khara, H., Behgozin, M., Yosefian, M., Rahbar, M., Ahmadnezhad, M. and Binaei, M. 2010a. Effect of age on reproductive performance in male kutum broods (*Rutilus frisii kutum*, Kamenskii 1901) in Tajan River. Journal of Fisheries, 4(3)(15):109-116. In Farsi.

Khara, H., Behgozin, M., Yosefian, M., Rahbar, M., Ahmadnezhad, M. and Binaei, M. 2010b. Effect of age on reproductive performance in female kutum broods (*Rutilus frisii kutum*, Kamenskii 1901) in Tajan River. Journal of Biology Science, 4(3)(series no. 14):55-63. In Farsi.

Khara, H., Keyvan, A., Nezami, Sh., Mehdinejad, K. and Mohammadjani, T. 2002. Diet of *Rutilus frisii kutum* x *Ctenopharyngodon idella* hybrid. Iranian Scientific Fisheries Journal, 11(2):31-42. In Farsi.

Khara, H., Keyvan, A., Pourkazemi, M., Vosoughi, Gh. H., Rezvani, S., Nezami, Sh. A., Hasanzadeh, M., Ghasemi, S. A., Ahmadnezhad, M. and Ghanaatparast, A. 2008. Genetic diversity of bream (*Abramis brama orientalis*) in south-west of Caspian Sea (Azerbaijan Republic coast) and Aras Dam Lake (north-west of Iran. Journal of Biology Science, 1(3)(series no. 3):23-33. In Farsi.

Khara, H., Keyvan, A., Pourkazemi, M., Vosoughi, Gh. H., Rezvani, S., Nezami, Sh. A., Hasanzadeh, M., Ghasemi, S. A., Ahmadnezhad, M. and Ghanaatparast, A. 2009. A survey of genetic diversity of bream (*Abramis brama orientalis*) in Anzali Wetland, south coast of Caspian Sea (Iran) and southwest coast of Caspian Sea (Azerbaijan Republic). Iranian Journal of Biology, 21(5):849-856. In Farsi.

Khara, H., Keyvan, A., Vosoughi, G., Pourkazemi, M., Rezvani, S., Nezami, S. A., Ramin, M., Sarpanah, A. N. and Ghanaatparast, A. 2007. Comparison of morphometric and meristic of bream (*Abramis brama orientalis* Berg 1905), in Caspian Sea and Anzali wetland. Pajouhesh va Sazandegi, 19(4)(73):177-187. In Farsi.

Khara, H., Keyvan, A., Vosoughi, Gh. H., Pourkazemi, M., Rezvani, S., Nezami, Sh. A., Ramin, M., Sarpanah, A. N. and Ahmadnezhad, M. 2007. Comparison of morphometric and meristic attributes of bream (*Abramis brama orientalis*) in Caspian Sea and Aras Dam reservoir. Iranian Scientific Fisheries Journal, 15(4):33-48. In Farsi.

Khara, H., Mazloumi, H., Nezami, Sh. A., Akbarzadeh, A., Gholipour, S., Ahmadnezhad, M., Fallah, S. F. and Rahbar, M. 2011. Water quality of Oshmak River (Guilan Province). New Technologies in Aquaculture Development (Journal of Fisheries), 5(3):41-54. In Farsi.

Khara, H., Nezami, S. and Sakari, M. 2004. Fish diversity in Boojagh marine and land National Park in the southern part of the Caspian Sea of Iran. Biology in Asia International Conference, Singapore, 7-10 December 2004 (abstract).

Khara, H., Nezami, Sh., Saeidi, A. A., Zahra, M., Abd Elahi, N., Alinia, M. R. and Ahamdinezhad, M. 2009. Kutum (*Rutilus frisii kutum*, Kamensky 1901) parasites of migratory to the Shirood River (Mazandaran Province). Journal of Biology Science, 3(3)(series no. 10):29-35. In Farsi.

Khara, H., Nezami, Sh. A., Sattari, M., Mirhasheminasab, S. F. and Mousavi, S. A. 2006a. An investigation on fish infection with *Diplostomum spathaceum* in Amirkalayeh Wetland. Iranian Scientific Fisheries Journal, 14(4):49-66. In Farsi.

Khara, H., Nezami, Sh. A., Sattari, M., Mirhasheminasab, S. F. and Mousavi, S. A. 2006b. An investigation on digestive parasites of fishes in Boojagh Wetland, north Iran. Iranian Scientific Fisheries Journal, 15(2):9-18. In Farsi.

Khara, H., Nezami, Sh. A., Sattari, M., Mirhasheminasab, S. F. and Mousavi Seyed, A. 2008. An

investigation on fish infection with *Diplostomum spathaceum* (Rudolphi, 1891) in Boojgah Wetland. Iranian Journal of Biology, 20(4):418-429. In Farsi.

Khara, H. and Nezami Baluchie, Sh. 2005. Studying fish biodiversity and abundance in Boujagh Wetland of Kiashar, south-western Caspian Sea. Iranian Scientific Fisheries Journal, 13(4):41-54. In Farsi.

Khara, H., Rashidi Karsalari, Z., Saeidi, A. A., Behrouzi, Sh., Rahbar, M. and Ahmadnezhad, M. 2012. Surveying some hematological parameters in male and female brood stocks of kutum fish (*Rutilus frisii kutum*) immigratory to Tejen River (Mazandaran Province). Journal of Fisheries, 6(3):127-136. In Farsi.

Khara, H., Rashidi Karsalari, Z., Saeidi, A. A., Behrozi, S., Rahbar, M. and Ahmadnezhad, M. 2011. Study of prevalence of parasitic infection in migratory kutum (*Rutilus frisii kutum* Kamensky, 1901) of Tajan River and its effect on some hematological parameters. Journal of Marine Biology, 3(1):31-39. In Farsi.

Khara, H., Sattari, M. and Nezami, S. 2005. Occurrence and intensity of some parasites in *Rutilus rutilus caspicus* (Cypriniformes: Cyprinidae) from the south-west of the Caspian Sea. Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Khara, H., Sattari, M., Nezami, S., Mirhasheminasab, S. F. and Mousavi, S. A. 2005. Parasites of some bonyfishes in Amirkelayeh wetland from the southwest of the Caspian Sea. 12th EAFP International Conference on Diseases of Fish and Shellfish, Copenhagen (title).

Khara, H., Sattari, M., Nezami, Sh., Mirhasheminasab, S. F., Mousavi, S. A. and Ahmadnezhad, M. 2011. Parasites of some bonyfish species from Boojagh wetland in the southwest shores of the Caspian Sea. Caspian Journal of Environmental Sciences, 9(1):47-53.

Khara, H., Sattari, M., Nezami Balochi, Sh., Mirhasheminasab, S., Bagherzadeh, D. and Yousefi, M. 2005. Occurrence and intensity of parasites from tench (*Tinca tinca* L., 1758) in Amirkelayeh wetland of Lahijan. Iranian Journal of Biology, 18(3):180-190. In Farsi.

Khatami, F., Shahsavani, D. and Baghishani, H. 2016. Investigation of the protective effect of spirulina in the prevention of lipid and protein oxidation in carp meat during different storage times. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Khatami, S. H. and Shayegan, S. J. 2003. Classification of springs in Kermanshah Province (Iran) based on water quality for sustainable sarabs utilization. Germany-Iran Alumni Network, Ist International Symposium cum-Workshop Sustainable Resource Utilization: Local Structures vs Globalization, September 14-18, Tehran University, pp. 311-320.

Khataminejad, S., Mousavi-Sabet, H., Sattari, M. and Vatandoust, S. 2013. First record of *Alburnus atropatenae* (Berg, 1925) (Cyprinidae) in Namak basin, central Iran. Croatian Journal of Fisheries, 71(2):77-79.

Khataminejad, S., Mousavi-Sabet, H., Sattari, M. and Vatandoust, S. 2015. Comparative study on morphological differentiation among five (*Alburnus*: Cyprinidae) species in Iranian water basins, by truss network system. Journal of Animal Ecology, 7(1):225-236. In Farsi.

Khataminejad, S., Mousavi-Sabet, H., Sattari, M., Vatandoust, S. and Eagderi, S. 2013. A comparative study on body shape of the genus *Alburnus* (Rafinesque, 1820) (*sic*) in Iran, using geometric morphometric analysis. Caspian Journal of Environmental Sciences, 11(2):205-215.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2013a. Morphometric and

meristic characteristics of Iranian kuli (Cyprinidae: *Alburnus hohenackeri*) in Mahabad-Chai River of Orumiyeh basin. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, pp. 87-92.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2013b. Morphometric and meristic characteristics study of kuli-ye Kura (Cyprinidae: *Alburnus filippii*) in the Baleqlu Chai River, northwestern of Iran. Aquaculture Europe, 9-12 August 2013, Trondheim, Norway. 3 pp.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2015a. Morphometric and meristic characteristics of shah kuli (*Alburnus chalcoides*: Cyprinidae) in Babolrud River of Mazandaran province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 26.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2015b. Morphometric and meristic characteristics of (*Alburnus atropatenae*: Cyprinidae) in Miriseh River of Azarbaijane gharbi province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 27.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2016. Morphometric and meristic characteristics studies of Kuli-ye Kura (cyprinidae: *Alburnus filippii*) in the Baleqlu Chai River, northwestern of Iran. Aquaculture Europe 2016, 20-23 September 2016, Edinburgh.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2017a. Characteristics morphometric and meristic of *Alburnus filippii* (Cyprinidae: *Alburnus filippii*) in the Baleqlu Chai River of Ardabil province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 330-334. In Farsi.

Khataminejad, S., Musavi-Sabet, H., Sattari, M. and Vatandoust, S. 2017b Characteristics morphometric and meristic of Zagros bleak (Cyprinidae: *Alburnus zagrosensis*) in Gandoman Lagoon of Chahar Mahal and Bakhtiari province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 336-341. In Farsi.

Khataminejad, S. S., Mousavi Sabet, S. H., Sattari, M. and Vatandoust, S. 2015. A comparative study on morphometric characters of five spirlin species (Cyprinidae: *Alburnus*) in Iranian inland waters using a truss network system. Journal of Animal Environment, 7(1):247-258. In Farsi.

Khatib Haghighi, S., Khaval, A., Moghadani, S. and Ghandi, A. 2018. Effectiveness of phytoplankton frequency in simultaneous in polyculture of carp pond with pike, *Esox lucius*. Journal of Aquaculture Development, 12(3):75-89. In Farsi.

Khatoonabadai, A. and Dehcheshmeh, A. R. M. 2006. Oil pollution in the Caspian Sea coastal waters. International Journal of Environment and Pollution, 26(4):347-363.

Khaval, A. 1996. *Rutilus frisii kutum*, *Alburnus chalcoides* and *Vimba vimba* nomadic to Sefidrood River. Fisheries Research Centre of Guilan, Iran. 69 pp.

Khaval, A. 1998. The migration of *Rutilus frissi* (sic) kutum, *Vimba vimba persa* and *Calcalburnus* (*sic*) *chalcoides* to the Sefidrud River. Iranian Scientific Fisheries Journal, 6(4):75-86, 7. In Farsi.

Khaval, A., Abbasi, K. and Valipour, A. 2010. Biological role of northern pike, *Esox lucius* (Linnaeus 1758) in control of aquatic pests in carps culture ponds. Iranian Scientific Fisheries Journal, 19(2):39-50. In Farsi.

Khazaee, A. R., Ghasemian, F., Ghassemzadeh, F., Ghanbarifardi, M. and Yazdani Moghaddam,

F. 2014. Phylogeny of snow trout (*Schizothorax*) based on cytochrome oxidase subunit 1 (COI) gene. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Khazraiinia, P., Payghan, R. and Azari Takami, Gh. 2001. Studies on the effect of experimental acute ammonia toxicity on serum enzymes, urea and cholesterol in common carp. Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(3):29-32. In Farsi.

Kheiri, A., Alaikbarlu, J. and Tehmasebi, R. 2020. Evaluation of antioxidant properties of perch and carp fish of Aras River and their health effects in humans. Studies in Medical Sciences, 30(12):981-993. In Farsi.

Kheyrandish, A., Abdoli, A. and Abdoli, L. 2014. Age and growth of *Capoeta damascina* (Valenciennes in Cuvier and Valenciennes 1842) in Daleki River of Boushehr province. Journal of Animal Researches (Iranian Journal of Biology), 26(4):425-434. In Farsi.

Khezri, K., Abdoli, A., Hasanzadeh Kiabi, B., Valikhani, H. and Aazami, J. 2019. Ecological integrity assessment of the Jajrood River using fish and macroinvertebrates indices. Environmental Sciences, 17(3):209-224. In Farsi.

Khlofe Nilsaz, M. 1996. Limnological study of Karoon River (Gotevand to Band-e-Ghir). Iranian Scientific Fisheries Journal, 4(4):25-32, 3. In Farsi.

Khodabaksh, E. and Ghobadi, S. 2014. Effects of dietary mixture of prebiotic mannan oligosaccharide (MOS) and β-glucan on growth performance, survival rate and body composition of juvenile grass carp (*Ctenopharyngodon idella*). Breeding and Aquaculture Sciences Quarterly, 1(1):41-54. In Farsi.

Khodabaksh, E. and Ghobadi, S. 2015. Effects of different dietary lipid sources on growth and nutrition performance, and survival rate of *Rutilus frissi* (*sic*) *kutum* juveniles. Breeding and Aquaculture Sciences Quarterly, 2(5):41-46. In Farsi.

Khodabakhsipour, M. and Ghasemi Zolpirani, R. 2021. Effects of water hyacinth (*Eichhornia crassipes*) expansion on the quantity and quality of aquatic habitat in the Anzali wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Khodabandeh, S. and Abtahi, B. 2006. Effects of sodium chloride, formalin and iodine on the hatching success of common carp, *Cyprinus carpio*. Journal of Applied Ichthyology, 22(1):54-56.

Khodabandeh S., Esmaili Sari, A., Abtahi, B. and Seifabadi, J. 2001. Distribution and density of ctenophores along the southern reach of the Caspian Sea. The Second International Iran and Russia Conference (Agriculture & Natural Resources), Moscow. Abstract, p. 167.

Khodabandeh, S, Esmaili Sari, A., Talaei, R. and Sifabadi, B. 2002. Regime alimentaire d’un cnidaire envahissant, *Mnemiopsis leidyi*, le long de la cote iranienne de la Mer Caspienne. Laboratoire d’Ecophysiologie des Invertebres, Université Montpellier, Brest (title).

Khodadadi, A., Rasuli, S., Abdi, K. and Azizi, R. 2013. Determination of abundance of external parasites of goldfish (*Carassius auratus* Linnaeus, 1758) in fish breeding and pisciculture centers in Urmia City. Journal of Veterinary Clinical Research, 4(1)(13):49-57.

Khodadadi, M., Ahmadi, S. and Dezfoulian, A. 2011. Morphological changes of *Barbus sharpeyi* larvae in laboratory conditions. Iranian Scientific Fisheries Journal, 20(3):173-178. In Farsi.

Khodadadi, M., Ansari, M., Peyghan, R., Mohammadi, Gh. H. and Raissy, M. 2009. Evaluation of some serum parameters of benni (*Barbus sharpeyi*) brood stocks in spawning season.

Journal of Marine Science and Technology Research, 4(3):37-43. In Farsi.
Khodadadi, M., Arab, A. and Jaferian, A. 2016. A preliminary study on sperm morphology, motility and composition of seminal plasma of shirbot, *Barbus grypus*. Turkish Journal of Fisheries and Aquatic Sciences, 16(4):947-951.
Khodadadi, M., Jagir, M., Rajabzadae Ghatami, E. and Masoomizadeh, S. Z. 2017. Effects of phytoplankton biomass on growth of fry silver carp (*Hypophthalmichthys molitrix*) in fish ponds of Shustar area. Journal of Aquaculture Development, 11(1):39-50. In Farsi.
Khodadadian Zou, H., Hoseinifar, S. H., Kolangi Miandare, H. and Hajimoradloo, A. 2016. *Agaricus bisporus* powder improved cutaneous mucosal and serum immune parameters and up-regulated intestinal cytokines gene expression in common carp (*Cyprinus carpio*) fingerlings. Fish and Shellfish Immunology, 58:380-386.
Khodadoust, A., Rasta, M., Khara, H. and Rahbar, M. 2013a. Determination of some biometry and fecundity indicators in female khramulia (*Capeta capoeta gracilis*, Keyserling 1861) in the Sefidroud River. World Journal of Fish and Marine Sciences, 5(4):392-397.
Khodadoust, A., Rasta, M., Khara, H. and Rahbar, M. 2013b. Determination of biometry and gonadosomatic index in male khramulia (*Capoeta capoeta gracilis*, Keyserling 1861) in the Sefidroud River. World Journal of Fish and Marine Sciences, 5(4):409-413.
Khodanazary, A., Boldaji, F., Tatar, A. and Dastar, B. 2013. Effects of dietary zeolite and perlite supplementations on growth and nutrient utilization performance, and some serum variables in common carp (*Cyprinus carpio*). Turkish Journal of Fisheries and Aquatic Sciences, 13(4):495-501.
Khodanazary, A. and Shabanpur, B. 2010. The comparison of changes in physicochemical content, bacterial and organoleptic properties in fillet and gutted common carp *Cyprinus carpio* during pickle salting. Iranian Journal of Food Science and Technology, 7(3):75-85. In Farsi.
Khodaparast, S. H., Babaei, H., Bagheri, S. and Khatib, S. 2018. Effect of *Carassius gibelio* on trophic status and food web at Neour Lake. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Khodaparast, S. H., Babaei, H., Moradi Chafi, M. and Abedini, A. 2018. Factors affecting decline of rainbow trout rearing in Neur Lake. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Khodaparast, S. H., Babaei, H., Zolfinjad, K. and Yousefzad, E. 2017. Survey on the potential production off (*sic*) plankton eater and benthic eater of the Shourabil Lake. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Khodaparast Sharifi, S. H., Moradi, I., Khodaparst, M., Babaei, H. and Abedini, A. 2016. The ecological role of exotic fish (*Carassius gibelio*) in water quality in Neoor Lake. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Khodashenas, A. K., Hedayati, S. A. A., Ghorbani, R., Hosseini, S. A. and Saghali, M. 2016. Study on the effects of shrimp effluent sewage in Gomishan shrimp farms in Golestan Province. Journal of Utilization and Cultivation of Aquatics, 5(2):73-81. In Farsi.
Khodjeini, A. V. and Mohamed, A. 1975. Etude du debit solide et de la sedimentation du barrage de Shah-Banou Farah. International Association of Hydrological Sciences, Hydrological Sciences Bulletin, 20(2):223-231.
Khojeini, A. V. 2003. Fluctuations of the Caspian Sea p. 77 (abstract). Global Threats to Large

Lakes, 46th Conference on Great Lakes Research, 10th World Lake Conference, June 22-26, 2003, DePaul University, Chicago. iv + 304 pp.
Khomami, S. A. 2017. The effects of dietary probiotic, *Pediococcus acidilactici*, on hematological parameters of Oriental bream, *Abramis brama orientalis*, fry. Journal of Fisheries Science and Technology, 6(1):1-12. In Farsi.
Khoramgah, M., Rezaei, M., Ojagh, S. M. and Babakhani Lashkan, A. 2007. Comparison of nutritional value and omega-3 fatty acids in muscle of wild and farmed common carp, *Cyprinus carpio*. Journal of Marine Sciences and Technology, 6(3-4):31-37. In Farsi.
Khoramian, S., Abdoli, A. and Youssefeian, S. 2013a. Back-calculation, growth parameters, length-weight relationship and condition factor of Shirbot (Cyprinidae: *Barbus grypus*), in Ejeyrob stream of Dez River in Dezfolul (*sic*) The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 40 (abstract).
Khoramian, S., Abdoli, A. and Youssefeian, S. 2013b. Ichthyofauna of Dez River in Khouzestan province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 41 (abstract).
Khoramian, S., Abdoli, A. and Youssefeian, S. 2013c. Determination of best scale radius for annual circuli counting and back-calculation of Shirbot (Cyprinidae: *Barbus grypus*). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 42 (abstract).
Khoramian, S., Abdoli, A. and Youssefeian, S. 2014a. Length-weight relationship and condition factor of shirbot (*Barbus grypus* Heckel, 1843) in Karkheh Dam of Andimeshk. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Khoramian, S., Abdoli, A. and Youssefeian, S. 2014b. Length-weight relationship and condition factor of tuini (*Capoeta trutta* Heckel, 1843) in Dez Dam of Dezfoul. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Khoramian, S., Abdoli, A. and Youssefeian, S. 2014c. A comparison of length-weight relationship and condition factor in hamri (*Cyprinidae*: *Barbus luteus*), and lootak (Cyprinidae: *Cyprinion macrostomum*), in Karkheh River of Andimeshk. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Khorasani, N. 2001. An environmental study of Jajrood River fauna and flora. Iranian Journal of Natural Resources, 54(1):31-4. In Farsi.
Khorasani, N. A., Farshchi, P., Monavari, M. and Jabari, H. 2004. Determination of the environment consequences of Shahr Chai Dam on natural environment of the region. Journal of Environmental Science and Technology, 2004(19):39-50. In Farsi.
Khorasani, N. A. and Rokni, M. A. 2001. Environmental study on floodgates of “Seyed Mahale” and Lapoye Zarrinkola”. Journal of Environmental Science and Technology, 2001(7-8):91-101. In Farsi.
Khorasaninasab, S. A., Keyvanshokooh, S., Pasha-Zanoosi, H. and Shahriari, A. 2020. Effects of egg stocking density on survival, antioxidant defense status, and stress and immune responses in the first life stages of binni (*Mesopotamichthys sharpeyi*). Aquaculture, 527:735436.
Khorasaninejad, M., Taati, R. and Abdollahpour Biria, H. 2019. A comparison of separate and combined levels of commercial multienzymes on feeding efficiency and carcass chemical

composition of common carp (*Cyprinus carpio*). Journal of Veterinary Research, 74(1):35-43. In Farsi.

Khorramgah, M. and Rezaie, M. 2013. Chemical and sensory changes of kutum (*Rutilus frisii kutum*) during frozen storage (-18°C). Iranian Journal of Food Science and Technology, 9(37):101-107. In Farsi.

Khorshidi, Z., Sarvi Moghanlou, K., Imani, A. and Behrouzi, S. 2018. The interactive effect of dietary curcumin and silver nanoparticles on gut microbiota of common carp (*Cyprinus carpio*). Iranian Journal of Science and Technology, Transactions A: Science, 42(2):379-387.

Khoshbavar Rostami, H. A. 2016. Environmental assessment of the Digche region in order to the development of warm-water fish culture. Iranian Fisheries Science Research Institute, Tehran. 220 pp. In Farsi.

Khoshkam, M., Marzuki, A. and Arzjani, Z. 2014. Wetland capabilities in enhancing wetland tourism in Gandoman, Ian. International Journal of Sustainable Development and Planning, 9(3):362-375.

Khoshkhial Saber, P. and Mortazavi Tabrizi, S. J. 2018. Identification of mesophilic *Lactobacillus* species in the intestine of *Rutilus kutum* fish in Caspian Sea with PCR test. Journal of Aquaculture Development, 12(1):35-44. In Farsi.

Khoshnamvand, M., Almasieh, K. and Kaboodvandpour, S. 2018. Assessment of mercury accumulation and magnification in a freshwater food chain: sediment, benthos and benthivorous fish. Iranian Journal of Toxicology, 12(5):17-22.

Khoshnamvand, M., Kaboodvandpour, S. and Ghiasi, F. 2013. A comparative study of accumulated total mercury among white muscle, red muscle and liver tissues of common carp and silver carp from the Sanandaj Gheshlagh Reservoir in Iran. Chemosphere, 90(3):1236-1241.

Khoshnamvand, M. and Kaboodvandpour, Sh. 2012. Assessment of total mercury bioaccumulation in white and red muscle and liver tissue of *Cyprinus carpio* collected from Sanandaj Gheshlagh Reservoir. Iranian Scientific Fisheries Journal, 21(1):79-88. In Farsi.

Khoshnamvand, M., Kaboudvandpour, Sh. and Ghiasi, F. 2010. A survey on accumulated mercury in different tissues of silver carp (*Hypophthalmichthys molitrix*) from Sanandaj Gheshlagh Dam. Iranian Journal of Health and Environment, 3(3):291-298. In Farsi.

Khoshnamvand, M., Mojodi, F. and Khosravi, R. 2016. Measurement and comparison of mercury concentration in different length groups of common carp muscle tissue from the Shadegan Wetland. Journal of Health and Development, 5(2):45-57. In Farsi.

Khoshnazar, A. and Nasrabadi, T. 2013. Evaluation of water quality in Ghezel-Uzan River in Eastern Azarbayjan using National Sanitation Foundation. Journal of Wetland Ecobiology, 4(14):19-29. In Farsi.

Khoshnood, Z. 2014. Identification and study of fish species in Karkheh River (Iran). Transylvanian Review of Systematical and Ecological Research, 16(2):97-106.

Khoshnood, Z. 2015. Histological structure of visual system in Caspian kutum (*Rutilus frisii kutum*) larvae and fingerling. Romanian Journal of Biology-Zoology, 60(1):61-68.

Khoshnood, Z., Jamili, Sh., Khodabandeh, S. 2015. Histopathological effects of atrazine on gills of Caspian kutum *Rutilus frisii kutum* fingerlings. Diseases of Aquatic Organisms, 113(3):227-234.

Khoshnood, Z., Jamili, Sh., Khodabandeh, S., Mashinchian Moradi, A. and Motalebi, A. A.

2015a. Studying the structure and ultrastructure and immunolocalization of the gill chloride cells in Caspian kutum *Rutilus frisii kutum* fry. Journal of Animal Researches (Iranian Journal of Biology), 27(4):498-508. In Farsi.

Khoshnood, Z., Jamili, Sh., Khodabandeh, S., Mashinchian Moradi, A. and Motalebi, A. A. 2015b. Toxic effects of atrazine herbicide on Caspian kutum, *Rutilus frisii kutum*, larvae. Journal of Animal Environment, 7(1):163-172. In Farsi.

Khoshnood, Z., Jamili, Sh., Khodabandeh, S., Masinchian Moradi, A. and Motallebi Moghanjoghi, A. A. 2014. Histopathological effects and toxicity of atrazine herbicide in Caspian kutum, *Rutilus frisii kutum*, fry. Iranian Journal of Fisheries Sciences, 13(3):702-718.

Khoshnood, Z. and Khoshnood, R. 2011. Effect of industrial wastewater on fish. Proceedings of the 3rd Aquatic Biodiversity International Conference, Sibiu/Transylvania, p. 104 (abstract).

Khoshravan, H., Naqinezhad, A., Alinejad-Tabrizi, T. and Yanina, T. 2019. Gorgan Bay environmental consequences due to the Caspian Sea rapid water level change. Caspian Journal of Environmental Sciences, 17(3):213-226.

Khoshravan, H., Naqinezhad, A., Alinejad-Tabrizi, T. and Yanina, T. 2021. Effects of the Caspian Sea water level change on Boujagh National Park, southwest the Caspian Sea. Caspian Journal of Environmental Sciences, 19(1):127-138.

Khoshzahmat, A., Tadjalli-pour, M. and Gafari Sadeghi, M. 1981. The study of the molluscs in the Parishan Lake and fish nutrition from molluscs point of view. Journal of the Veterinary Faculty of the University of Tehran, 37(3):23-36. In Farsi.

Khosravanizadeh, A., Pourkazemi, M. and Nowruz Fashkhami, M. R. 2011. Karyology study on bleak (*Alburnus alburnus*) from the south Caspian Sea region. Caspian Journal of Environmental Sciences, 9(1):27-36.

Khosravanizadeh, A., Pourkazemi, M. and Nowruzfashkhami, M. R. 2013. Karyology study of spirlin (*Alburnoides bipunctatus*) in Zabol region. Iranian Scientific Fisheries Journal, 22(2):137-146. In Farsi.

Khosravi, M., Abdoli, A., Ahmadzadeh, F., Saberi-Pirooz, R., Rylková, K. and Kiabi, B. H. 2020. Toward a preliminary assessment of the diversity and origin of Cyprinid fish genus *Carassius* in Iran. Journal of Applied Ichthyology, 36(4):422-430.

Khosravi, M., Shamsaye Mehrjan, M. and Akrami, R. 2010. The impact of different levels of inulin as prebiotic in diet on the growth performance and body composition of roach fry (*Rutilus rutilus caspicus*). Renewable Natural Resources Research, 1(2):98-107. In Farsi.

Khosravi Bakhtiarvandi, N., Abedian Kenari, A., Mohammad Nazari, R. and Makhdoomi, C. 2014. Ontogenetic changes in lipids, fatty acid, and body composition during larval stages of Caspian kutum (*Rutilus frisii kutum*). Iranian Journal of Fisheries Sciences, 13(2):365-383.

Khosravi Bakhtiarvandi, N., Abedian Kenari, A., Nazari, R. M. and Makhdoumi, Ch. 2012. Changes in growth and amino acid composition of *Rutilus frisii kutum* during larval development. Iranian Scientific Fisheries Journal, 21(1):65-78. In Farsi.

Khosravi Katuli, K. 2016. Effect of azinophos-methyl and diazinon on blood biochemical and hematological indices of Caspian roach (*Rutilus rutilus*). Journal of Utilization and Cultivation of Aquatics, 5(1):57-71. In Farsi.

Khosravi Katuli, K., Eagderi, S. and Nowferesti, H. 2013. Phenotypic plasticity of body shape in three populations of false rasbora (*Pseudorasbora parva*) using geometric morphometric

method. Journal of Utilization and Cultivation of Aquatics, 2(4):61-71. In Farsi.
Khosravi Katuli, K., Jafaryan, H., Abdollahi, D. and Tavana, S. 2013. Performance evaluation of combined probiotic *Bacillus* and yeast *Saccharomyces cerevisiae* isolated from the digestive tract of *Huso huso* on growth factors and biochemical body extracts improvement and increased resistance of silver carp (*Hypophthalmichthys molitrix*) larvae in the face of stressors. Journal of Fisheries (Iranian Journal of Natural Resources), 66(4):441-451. In Farsi.
Khosravi Katuli, K., Mojazi Amiri, B., Smaeelzadegan, S. and Yelghi, S. 2012. The effect of diazinon on osmoregulation capability in Caspian roach (*Rutilus rutilus*) fingerlings. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 364-368.
Khosravi Katuli, K., Mojazi Amiri, B., Smaeylzadegan, S. and Yelghi, S. 2012. Histopathological changes in the gill of Caspian roach (*Rutilus rutilus*) exposed to diazinon. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 369-373.
Khosravi Katuli, K., Shabani, A. and Kolangi Miyandareh, H. 2018. Effect of sub lethal concentrations of silver nanoparticles and silver nitrate on Hsp70 gene expression and gill, liver and intestinal damage in common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(4):339-350. In Farsi.
Khosravi Katuli, K., Shabani, A., Paknejad, H. and Imanpoor, M. R. 2018. Comparative toxicity of silver nanoparticle and ionic silver in juvenile common carp (*Cyprinus carpio*): Accumulation, physiology and histopathology. Journal of Hazardous Materials, 359:373-381.
Khosravi Katuli, K., Shabani, A., Paknejad, H. and Imanpour, M. R. 2019. The effects of sub-lethal concentrations of silver nanoparticles and silver nitrate on common carp (*Cyprinus carpio* L.): changes in hematology and antioxidants. Journal of Animal Environment, 11(1):239-246. In Farsi.
Khosravi Najafabadi, A., Jafaryan, H., Adineh, H. and Harsij, M. 2020. Effect of two prebiotic (A-Max Ultra and Celmanax liquid) inoculation in water quality, growth performance and carcass composition of common carp (*Cyprinus carpio*) fingerlings in biofloc system. Journal of Animal Environment, 12(2):177-188. In Farsi.
Khosravikatuli, K., Kolangi Miyandareh, H., Mojazi Amiri, B. and Azadi, H. 2018. Assessment of oxidative stress biomarkers in Caspian roach (*Rutilus rutilus caspicus*) exposed to sub-lethal concentrations of diazinon. Journal of Applied Ichthyological Research, 6(1):35-50. In Farsi.
Khosravizadeh, A. 2018. Comparison of anesthetic effects of clove oil in angelfish (*Pterophyllum scalare*), guppy (*Poecilia reticulate* (*sic*)) and goldfish (*Carassius auratus*). Journal of Animal Environment, 10(3):315-322. In Farsi.
Khosravizadeh, M., Ghofleh Maramazi, J., Kochanian, P., Nikpey, M., Rajabzadeh, E., Yavari, V. and Sahraeain, M. R. 2011. Effects of varying dietary energy levels on growth performance and wholebody composition in gattan (*Barbus xanthopterus*) fingerlings. Journal of Marine Sciences and Technology, 10(1):53-64. In Farsi.
Khosropanah, N., Nejatkhah-Manavi, P., Koohilay, S. and Naseri, M. T. 2011. Variations in nitrate and phosphate contents of waters in the Southwest Caspian Sea. Journal of the

Persian Gulf, 2(5):27-33.
Kiabi, B. 1996. Zoology of Shadegan wetland. Khuzestan Fishery Research Center, Ahvaz.
Kiabi, B. H. 2004. Biodiversity of fish species in inland waters of north-east parts of Iran. Program of the XIXth International Congress of Zoology, August 23-27, 2004, Beijing, China (title).
Kiabi, B. H. and Abdoli, A. 1999. A preliminary study of inland water fish distribution and abundance in Hormozgan Province (with emphasis on endemic species in rivers). Seventh International Symposium on the Ecology of Fluvial Fishes, 10-13 May 1999, Lodz, Poland (title).
Kiabi, B. H. and Abdoli, A. 2000. Fish distribution and abundance in the inland waters of Hormuzgan Province, Iran, with particular reference to endemic species in rivers. Polskie Archiwum Hydrobiologii, 47(1):87-98.
Kiabi, B. H., Abdoli, A. and Naderi, M. 1999. Status of the fish fauna in the South Caspian Basin of Iran. Zoology in the Middle East, 18(1):57-65.
Kiabi, B. H., Ghaemi, R. and Abdoli, A. 1999. Wetland and riverain ecosystems of Golestan province. Department of the Environment, Golestan Provincial Office of Department of the Environment, Gorgan. 182 pp. In Farsi.
Kiabi, B. H., Majnoonian, H. G. and Mansoori, J. 2004. Suggested criteria to evaluate the conservation status of Iran wetlands. Journal of Environmental Studies, 30(33):74-89. In Farsi.
Kiabi, B, H.-Z., Zehzad, B., Darreh-Shoori, B. F., Majnounian, H. and Meigouni, H. G. 1994. Golestan National Park. Department of the Environment, Tehran. 203 pp. In Farsi.
Kianersi, F. 2017. Environmental impact assessment for Indian carp introduction to Azadegan fish pond. Iranian Fisheries Science Research Institute, Tehran. 182 pp. In Farsi.
Kiani, F., Hashemzadeh Segherloo, I., Abdoli, A., Shaloee, F. and Nikukhah, F. 2017. Phylogenetic analysis of the genus *Garra* in Karun, Karkheh, Dez, Tigris, and Mond basins (Iran) using cytochrome oxidase subunit I. Modern Genetics Journal 12(1):69-91. In Farsi.
Kiani, S. and Keivany, Y. 2013. Biometry of large scaled barb, (Cyprinidae: *Capoeta aculeata*), from Qomrud River. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 76 (abstract).
Kiani, F., Keivany, Y. and Paykan-Heyrati, F. 2021. Reproductive biology and gonad histology of king nase (*Chondrostoma regium*) (Teleostei: Cyprinidae) in Bibi-Sayyedan River, Tigris basin. Biharean Biologist, 15(1):25-32.
Kiani, F., Keivany, Y., Paykan-Heyrati, F. and Farhadian, O. 2016. Age and growth of king nase, *Condrostoma* (*sic*) *regium* (Cyprinidae), from Bibi-Sayyedan River of Semirom, Isfahan, Iran. Iranian Journal of Fisheries Sciences, 15(3):1214-1223.
Kiani, F., Keivany, Y., Peykan-Heyrati, F. and Farhadian, O. 2012. Gonadosomatic index and egg diameter variations in the king nase inhabiting Bibi-Sayyedan River of Semirom, Isfahan, Iran. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 374-378.
Kiapasha, F., Khoshkholgh, M. and Falahatkar, B. 2019. Effect of replacement of different levels of dietary olive pomace on growth blood indices of common carp fingerling (*Cyprinus carpio*). Journal of Animal Environment, 11(2):179-186. In Farsi.
Kiarsi Alikhani, E., Eagderi, S., Poorbagher, H. and Amini, M. 2019. Allometric growth pattern

and morphological changes in binni (*Mesopotamichthys sharpeyi*) during early ontogeny. Journal of Aquaculture Sciences, 7(1):103-109. In Farsi.

Kideys, A., Finenko, G. A., Anninsky, B. E., Shiganova, T. A., Roohi, A., Tababri, M. R., Youseffyan, M., Rostamian, M. T., Rostami, H. and Negarestan, H. 2004. Physiological characteristics of the ctenophore Beroe ovata in Caspian Sea water. Marine Ecology Progress Series, 266:111-121.

Kideys, A. E. 2002a. Fall and rise of the Black Sea ecosystem. Science, 297(5586):1482-1484.

Kideys, A. E. 2002b. The invasive ctenophore *Mnemiopsis* problem in the Black and Caspian Seas. Biomare Newsletter, 3:5-6 pp. (www.biomareweb.org/3.3.html).

Kideys, A. E. and Moghim, M. 2003. Distribution of the alien ctenophore *Mnemiopsis leidyi* in the Caspian Sea in August 2001. Marine Biology, 142(1):163-171.

Kiliç, D. and Şişman, T. 2016. Karyotype analysis of chub, *Squalius cephalus* (Linnaeus, 1758) (Teleostei: Cyprinidae) from Karasu River, Erzurum, Turkey. Caspian Journal of Environmental Sciences, 14(2):95-103.

Kılıç Demirok, N. and Ünlü, E. 2001. Karyotypes of cyprinid fish *Capoeta trutta* and *Capoeta capoeta umbla* (Cyprinidae) from the Tigris River. Turkish Journal of Zoology, 25(4):389-393.

Kimball, K. D. 1973. A preliminary investigation of Caspian Sea water penetration into the effluent rivers of the Pahlavi marsh. Technical Report, Fisheries Research Institute, Bandar Pahlavi, Iran. MS, 5 pp.

Kimball, K. D. and Kimball, S. F. 1974. The limnology of the Pahlavi Mordab, Iran: A study of eutrophication problems. Human Environment Division, Department of the Environment, Iran. MS, 43 pp.

Kimball, K. D. and Shayegan, H. 1973. A limnological study of the Pahlavi marsh and its effluent river system during the year (1971-1972) 1350. Technical Report, Fisheries Research Institute, Bandar Pahlavi, Iran. MS, 40 pp.

Kingsford, R. (Ed.). 2006. Ecology of Desert Rivers. Cambridge University Press. xiv + 354 pp.

Kinneir, J. M. 1813. A Geographical Memoir of the Persian Empire, accompanied by a map. John Murray, London. viii + 486 pp.

Kinunen, W. 1972. Lar River creel census. Report No. S-2-51-1, Department of Environmental Conservation, Tehran. MS.

Kinunen, W., Bullock, S. and Bosch, M. 1970. Nam-rud and Dali-chay Survey. Progress Report 1970, Iran Game and Fish Department, Tehran, pp. 9-10.

Kizina, L. P. 1986. Some data on the biology of the genus Carassius from the lower reaches of the Volga Delta. Journal of Ichthyology, 26(4):31-40.

Klige, R. K. and Myagkov, M. S. 1992. Changes in the water regime of the Caspian Sea. GeoJournal, 27(3):299-307.

Klinkhardt, M., Tesche, M. and Greven, H. 1995. Database of Fish Chromosomes. Westarp Wissenschaften, Magdeburg. 237 pp.

Kloosterman, K. 2014. Raw human sewage murders millions of fish in Iran. Green Prophet, 24 April 2014 (www.greenprohet.com).

Klykov, A. A., Morozov, A. V., Smetanin, K. A. and Bulgakov, G. P. 1929. Rybnoe khozyaistvo Turkmenistana (Kaspiiskoe poberezh'e) [Fisheries of Turkmenistan. The Caspian Coast]. Trudy Nauchnogo Instituta Rybnogo Khozyaistva, 5(1):216 pp.

Knipovich, N. M. 1921. Gidrologicheskie issledovaniya v Kaspiiiskom more v 1914-1915 g. [Hydrological investigations in the Caspian Sea in the years 1914-1915]. Trudy

Kaspiiskoi Ekspeditsii, 1914-1915 gg., Petrograd, 1:xxviii + 943 pp.
Kobori, I. and Glantz, M. H. (Eds.). 1998. Central Asian Water Crisis: Caspian, Aral, and Dead Seas. United Nations University Press (www.unu.edu/unupress/unupbooks/uu18ce/uu18ce00.htm, downloaded 28 August 2002).
Kocaman, E. M., Yanik, T. and Güneş, M. 2002. Some population parameters of *Capoeta capoeta umbla* (Heckel, 1843), living in Tuzla Stream of Karasu River. Atatürk Üniversitesi Ziraat Fakültesi Dergisi, 33(3):309-312.
Kochakian Sabour, A. 1996. Providing frozen minced fish meat. Iranian Scientific Fisheries Journal, 5(1):18-24, 2-3. In Farsi.
Kohestan-Eskandari, S., Anvarifar, H., Mousavi-Sabet, H., Yousefi, M. and Khanzade, M. 2014. A morphology-based hypothesis for homeward migration success and population differentiation in the anadromous kutum *Rutilus kutum* (Pisces: Cyprinidae) along the southern Caspian Sea, Iran. Folia Zoologica, Brno, 63(3):151-160.
Kohnechahry, M. and Heydarpur, E. 1973. Élevage de truites et de carpes dans l'eau immobill (*sic*) des lacs à l'interieur de nasses immergées. Journal of the Veterinary Faculty of the University of Tehran, 29(2):21-29. In Farsi.
Kolahi, M., Sakai, T., Moriya, K., Makhdoum, M. F. and Koyama, L. 2013. Assessment of the effectiveness of protected areas management in Iran: Case study in Khojir National Park. Environmental Management, 52(2):514-530.
Kolangi Miandare, H. 2016. Genetic characterization of *Garra rufa* (Heckel, 1843) populations in Tigris basin, Iran using microsatellite markers. International Journal of Aquatic Biology, 4(1):57-67.
Kolangi Miandareh, H., Shabany, A. and Hojati, M. 2015. Investigating genetic diversity of *Rutilus kutum* (Kamenskii, 1901) in some rivers in southern of the Caspian Sea using cytochrome b gene (mtDNA-Cytb) sequences. Journal of Applied Ichthyological Research, 3(2):1-12. In Farsi.
Kolar, C. S., Chapman, D. C., Courtenay, W. R., Housel, C. M., Williams, J. D. and Jennings, D. P. 2005. Asian carps of the genus *Hypophthalmichthys* (Pisces, Cyprinidae) - a biological synopsis and environmental risk assessment. Report to the U.S. Fish and Wildlife Service per Interagency Agreement 94400-3-0128. vi + 175 pp. (www.asiancarp.org/risks.asp).
Kolar, C. S. and Lodge, D. M. 2002. Ecological predictions and risk assessment for alien fishes in North America. Science, 298(5596):1233-1236.
Koliaee, Z., Aberoumand, A. and Ziaei Nejad, S. 2016. The effect of probiotic *Bacillus subtilis* bacteria extracted from the intestine of common carp (*Cyprinus carpio*) on growth performance and survival of the fish. Journal of Aquaculture Development, 10(2):99-108. In Farsi.
Koliaee, Z., Aberoumand, A., Ziaeinejad, S. and Jevaheri Baboli, M. 2016. The effect of probiotic bacteria of *Bacillus subtilis* on fatty acid profiles of common carp (*Cyprinus carpio*) fillet. Journal of Utilization and Cultivation of Aquatics, 5(2):17-29. In Farsi.
Komarova, A.S., Rozanova, O. L. and Levin, B. A. 2021. Trophic resource partitioning by sympatric ecomorphs of *Schizopygopsis* (Cyprinidae) in a young Pamir Mountain lake: preliminary results. Ichthyological Research, 68(1):191-197.
Kompani-Zare, M. and Moore, F. 2001. Chemical thermometry and origin of the Dalaki mineral springs, Bushehr Province, Iran. Journal of Hydrology, New Zealand, 40(2):189-204.
Konar, V., Canpolat, A., Yılmaz, Ö. and Gürsu, F. 1999. *Capoeta trutta* ve *Barbus rajanorum*

mystaceus'un Kas Dokularındaki Total Lipit ve Yağ Asidi Miktar ve Bileşimlerinin Üreme Periyodu Süresince Değişimi [Variation of total lipid and fatty acid amount and compositions in muscles of *Capoeta trutta* and *Barbus rajanorum mystaceus* during reproduction period]. Turkish Journal of Biology, 23(3):319-330.

Kontaş, S., Yedier, S. and Bostancı, D. 2020. Otolith and scale morphology of endemic fish *Cyprinion macrostomum* in Tigris-Euphrates basin. Journal of Ichthyology, 60(4):562-569.

Koocheki, A. 1996. Qanat, a sustainable ancient system for exploitation of underground water in Iran. 11th IFOAM (International Federation of Organic Agriculture Movements) Scientific Conference, 11-15 August 1996, Copenhagen, ifoam '96, Book of Abstracts. S18.

Koohkan, O., Abdi, R., Salighehzadeh, R. and Jaddi, Y. 2014. Histopathological study on sub-acute toxicity of paraquat on liver of benny fish fingerling (*Barbus sharpeyi*). Journal of Comparative Pathobiology, 11(1)(44):1167-1172.

Koohilai, S., Oryan, Sh. and Hosseinzadeh Sahafi, H. 2010a. The study of $LHRHa_2$, metoclopramide and chlorpromazine's optimum dose, by measurement of GTH II plasma in female bream (*Abramis brama orientalis*) (Berg, 1905). Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):29-37. In Farsi.

Koohilai, S., Oryan, Sh. and Hosseinzadeh Sahafi, H. 2010b. The study of $LHRHa_2$ and dopamine antagonists on gonadotropin II level in *Abramis brama orientalis* (Berg, 1905). Journal of Veterinary Research, 65(2):109-113. In Farsi.

Koohilai, S., Oryan, Sh., Hosseinzadeh Sahafi, H., Mostafavi, P. G. and Behzadi, S. 2017. Ovulation and spawning induction in Caspian kutum *Rutilus frisii kutum* by administration of GnRHa and catecholaminergic pharmaceutical compounds with ovaprim. Aquaculture Research, 48(4):1469-1477.

Koohilai, S., Oryan, Sh., Hosseinzadeh Sahafi, H., Mostafavi, P. G., Shahi, N. and Behzadi, S. 2015. The sytudy (*sic*) of 17β-estradiol and 17α-hydroxyprogeterone (*sic*) levels of plasma by administration of dopaminergic and adrenergic agonist & antagonists with GnRHa and ovaprim in Caspian kutum *Rutilus frisii kutum* (Kamenskii, 1901). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 37-38.

Koohilai, S., Oryan, Sh., Hosseinzadeh Sahafi, H., Mostafavi, P. G. and Behzadi, S. 2017. The study of changes in 17β-estradiol and 17α-hydroxyprogeterone (*sic*) levels of plasma by administration of dopaminergic and adrenergic agonist & antagonists with GnRHa and ovaprim in Caspian kutum *Rutilus frisii kutum*. Journal of Animal Environment, 9(1):217-222. In Farsi.

Köpp, H. and Yachkaschi, A. 1978. Development and status of protected areas in Iran. Parks, 2(4):11-13.

Kor, A. 2010. The role of educational-extension activities on meeting problems of fish breeding of Golestan Province. M.Sc. Thesis, Islamic Azad University.

Kor, A., Patimar, R., Harsij, M. and Bahalkeh, A. 2017. Reproductive characteristics of *Capoeta razii* in Zav River in Golestan National Park. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Kor, A., Patimar, R., Harsij, M. and Bahalkeh, A. 2017. Study of growth pattern of *Capoeta razii* in Zav River, Golestan National Park. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Kor, A., Patimar, R., Harsij, M. and Bahalkeh, A. 2018. Investigation of reproductive biology of *Capoeta gracilis* (Keyserling, 1861) in Zav River, Golestan National Park. Journal of Animal Environment, 10(3):339-348. In Farsi.

Kor, A., Patimar, R., Raeisi, H. and Shakiba, M. 2020. Age and growth characteristics of Caspian Roach broodstocks (*Rutilus lacustris*) used for semi-natural propagation and stock enhancement programs. Journal of Aquaculture Sciences, 8(1):154-166. In Farsi.

Kordi, H., Imanpour, M. R. and Sedaghat, S. 2012. Effect of L-carnitine supplementation on growth performance and carcass composition of Caspian roach (*Rutilus rutilus Caspicus* (*sic*)). World Journal of Fish and Marine Sciences, 4(4):396-399.

Kordjazi, M., Imanpoor, M. R. and Shabanpour, B. 2012. The relationship between water salinity and EC with hematocrite, blood serum ionic parameters, growth, survival and stress indices in common carp (*Cyprinus carpio* Linnaeus, 1758). Journal of Fisheries (Iranian Journal of Natural Resources), 64(4):319-332. In Farsi.

Kordjazi, M. and Imanpour, M. R. 2010. The correlation between some biochemical parameters of water and blood serum in common carp (*Cyprinus carpio* Linnaeus, 1758). Iranian Journal of Biology, 23(4):596-604. In Farsi.

Kordjazi, M., Imanpour, M. R. and Shabanpour B. 2009. The correlation between some water ionic and nonionic parameters with haematocrit indicator growth and survival of common carp in culturative ponds. Journal of Agricultural Sciences and Natural Resources, 16(Special Issue 1-A). In Farsi.

Korki, M. 1992. Hawr-al-Azim or Hawr-al-Hoveyzeh (a nature inside the nature). Abzeeyan, Tehran, 3:82-83. In Farsi.

Korkmaz, M. and Yerli, S. V. 2015. Phylogenetic position of Barbus lacerta Heckel, 1843. XV European Congress of Ichthyology, Porto, Portugal, 7-11 September, 2015 (poster).

Kosarev, A. N. and Yablonskaya, E. A. 1994. The Caspian Sea. SPB Academic Publishing, The Hague. xiii + 259 pp.

Koshara, A. V. and Izyumov, Yu. G. 1991. The intraspecific systematics of the bream, *Abramis brama* (Cypriniformes, Cyprinidae). Journal of Ichthyology, 31(8):29-41.

Kosswig, C. 1951. Contributions to the knowledge of the zoogeographical situation in the Near and Middle East. Experientia, 7(2):401-406.

Kosswig, C. 1952. Die Zoogeographie der türkischen Süßwasserfische. Istanbul Üniversitesi Fen Fakültesi Hidrobiologi Araştirma Enstitüsü Yayınlarından, Seri B, 1(2):85-101.

Kosswig, C. 1955a. Zoogeography of the Near East. Systematic Zoology, 4(2):49-73, 96.

Kosswig, C. 1955b. Contributions to the historical zoogeography of African freshwater fishes. Istanbul Üniversitesi Fen Fakültesi Hidrobiologi Araştırma Enstitüsü Yayınlarından, Seri B, 2(2/3):83-91.

Kosswig, C. 1965. Zur historischen Zoogeographie der Ichthyofauna im Süsswasser des sudlichen Kleinasiens. Zoologische Jahrbücher für Systematik, 92:83-90.

Kosswig, C. 1967. Tethys and its relation to the peri-Mediterranean faunas of fresh-water fishes, pp. 313-324. In: Adams, C. G. and Ager, D. V. (Eds.). Aspects of Tethyan Biogeography. Systematics Association Publication, 7:vi + 336 pp.

Kosswig, C. 1973. Über die Ausbreitungswege sogenannter perimediterraner Süßwasserfische. Bonner Zoologische Beiträge, 24:165-177.

Kostianoy, A. G. and Kosarev, A. N. (Eds.). 2005. The Caspian Sea Environment. Springer Science and Business Media. xiv + 271 pp.

Kotlík, P., Marková, S., Choleva, L., Bogutskaya, N. G., Ekmekçi, F. G. and Ivanova, P. P. 2008.

Divergence with gene flow between Ponto-Caspian refugia in an anadromous cyprinid *Rutilus frisii* revealed by multiple gene phylogeography. Molecular Ecology, 17(4):1076-1088.

Kottelat, M. 1987. Nomenclatural status of the fish names created by J. C. van Hasselt (1823) and of some cobitoid genera. Japanese Journal of Ichthyology, 33(4):368-375.

Kottelat, M. 1997. European freshwater fishes. An heuristic checklist of the freshwater fishes of Europe (exclusive of former USSR), with an introduction for non-systematists and comments on nomenclature and conservation. Biologia, Bratislava, 52 (Supplement 5):1-271.

Kottelat, M. 2013. The fishes of the inland waters of Southeast Asia: a catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. The Raffles Bulletin of Zoology, Supplement, 27:1-663

Kottelat, M. 2016. On *Gonorynchus*, *Gonorhynchus*, *Gonorinchus*, *Gonorhinchus* and *Gonorrhynchus*, and some other names of labeonine fishes (Teleostei: Gonorynchidae and Cyprinidae). Zootaxa, 4178(3):443-450.

Kottelat, M. 2017. *Carassius praecipuus*, a dwarf new species of goldfish from the Mekong drainage in central Laos (Teleostei: Cyprinidae). Revue suisse de Zoologie, 124(2):323-329.

Kottelat, M. and Freyhof, J. 2007. Handbook of European Freshwater Fishes. Kottelat, Cornol, Switzerland and Freyhof, Berlin, Germany. xiii + 646 pp.

Kottelat, M., Nielsen, J. G. and Nijssen, H. 1993. Survey of ichthyological resources in European museums and collections. Verlag Dr. Friedrich Pfeil, Munich. 24 pp.

Kouchoukos, N., Smith, R., Gleason, A., Thenkabail, P., Hole, F., Barkoudah, Y., Albert, J., Gluhosky, P. and Foster, J. 1998. Monitoring the distribution, use, and regeneration of natural resources in semi-arid Southwest Asia. Yale School of Forestry & Environment Studies Bulletin, 103:467-491.

Kouh Nejad, A. and Azarpour, P. 2003. Morphometric and meristic studies on *Alburnus chalcoides* migrant to Chamkhaleh River of Langroud. Bachelor of Fisheries Project, Islamic Azad University of Lahijan, Iran.

Kouhestan Eskandari, S. 1998. Investigation of some biological and ecological parasitological characteristics of khramulya *Capoeta capoeta gracilis* in the river of Golestan National Park. M.Sc. Thesis, Tarbiat Modarres University. 112 pp. In Farsi.

Kouhestan Eskandari, S. 2003. Population dynamic of *Capoeta capoeta gracilis* in Madarsoo Stream in Golestan National Park. Journal of Marine Sciences and Technology, 2(2-3):11-20. In Farsi.

Kouhestan Eskandari, S., Khalesi, M. K., Khoramgah, M., Asgari, S. and Mirzakhani, N. 2018. Models for length back-calculation in Caspian kutum, *Rutilus kutum* (Pisces: Cyprinidae) from the Caspian Sea. Caspian Journal of Environmental Sciences, 16(1):13-23.

Kouhi-Dehkordi, S. and Bani, A. 2017. Day-night behavior in river entry of kutum and its relation to melatonin. Biological Rhythm Research, 48(6):951-962.

Kouhi Dehkordi, S., Khalili Tilami, S. and Imanpour, J. 2016. Induced histopathological alterations in selected organs of *Rutilus kutum* exposed to polluted waters in Anzali Lagoon. Journal of Animal Environment, 8(3):133-144. In Farsi.

Koukabi, L. and Aminzadeh, BB. 2009. Application of landscape ecology in conservation and restoration of urban rivers: The case of Khoshk River in Shiraz. Environmental Sciences, 6(2):105-119. In Farsi

Koulaei, E. and Ghoudarzi, M. 2009. Ecological threats in the Caspian Sea and the role of the Tehran Convention. Environmental Sciences, 7(1):69-93. In Farsi.

Kourandeh, H. H. 2012. Qualitative assessment and classification of Aji Chi River using water quality index (WQD). World Journal of Fish and Marine Sciences, 4(1):50-53.

Kousha, A. and Askarian, F. 2006a. SBP as a biomarker in kutum blood. 93rd Indian Science Congress Association (ISCA), Section of Fisheries, Hyderabad, India (title).

Kousha, A. and Askarian, F. 2006b. Role of packaging in quality improve (*sic*) of fish processing for consumers in Iran market. World Aquaculture Society, Aqua 2006, May 9-13. Florence, Italy (abstract).

Kousha, A., Askarian, F., Ghate, H. V. and Ghole, V. S. 2006. Use of biotechnology on food processing and quality of fish products in Iran. World Aquaculture Society, Aqua 2006, May 9-13. Florence, Italy (abstract).

Kousha, A., Askarian, F., Ghate, H. V. and Ghole, V. S. 2007. Study on sex steroid-binding proteins (with emphasize (*sic*) on 17β-estradiol) in plasma of female and juvenile kutum (*Rutilus frisii kutum*). Iranian Journal of Fisheries Sciences, 6(2):77-92.

Kousha, A., Askarian, F., Ghate, H. V., Yousefian, M. and Ghole, V. S. 2006. Investigation on sex steroid binding protein (SBP) as a biomarker for sexual behaviour of kutum (*Rutilus frissi* (*sic*) *kutum*). World Aquaculture Society, Aqua 2006, May 9-13. Florence, Italy (abstract).

Kousha, A., Askarian, F., Yousefian, M., Ghate, H. V. and Ghole, V. S. 2009. Annual fluctuation of sex steroid hormones in pre-spawning female kutum (*Rutilus frissi* (*sic*) *kutum*). World Journal of Fish and Marine Sciences, 1(1):65-73.

Kováč, M., Hudáčková, N., Halásová, E., Kováčová, M., Holcová, K., Oszczypko-Clowes, M., Báldi, K., Less, G., Nagymarosy, A., Ruman, A., Klučiar, T. and Jamrich, M. 2017. The Central Paratethys palaeoceanography: a water circulation model based on microfossil proxies, climate, and changes of depositional environment. Acta Geologica Slovaca, 9(2):75-114.

Kovda, V. A. 1961. Land use development in the arid regions of the Russian Plain, the Caucasus and Central Asia. In: Stamp, L. D. Arid Zone Research - XVII. A history of land use in arid regions. UNESCO, Paris. 388 pp.

Kozhara, A. V. 2005. Structural traits of the axial skeleton in some groups of genera of Leuciscinae (Cyprinidae). Journal of Ichthyology, 45(8):566-576.

Kozhara, A. V., Izyumov, Yu. G., Kasyanov, A. N. and Zelenetskii, N. M. 1999. Dependence of vertebral numbers on water body type in freshwater fish. Journal of Ichthyology, 39(3):209-217.

Kozhara, A. V. and Mironovskiy, A. N. 1988. Species structure, variability and some aspects of the microphylogeny of the bream, <u>Abramis</u> <u>brama</u>. Journal of Ichthyology, 28(1):108-121.

Kozhin, N. I. 1957. Materialy po ikhtiofaune iranskogo poberezh'ya Kaspiya [Material on the ichthyofauna of the Iranian coast of the Caspian Sea]. Voprosy Ikhtiologii, 8:8-18.

Krasznai, Z. L. 1987. Mission to Iran to assess the needs in coldwater fish culture 14 August - 2 September 1987. A report prepared for the project Training Course in Coldwater Fisheries. Food and Agriculture Organization, Rome, TCP/IRA/6755(T), Field Document 1:iii + 23 pp.

Krijgsman, W., Tesakov, A., Yanina, T., Lazarev, S., Danukalova, G., Van Baak, C. G. C., Agustí, J., Alçiçek, M. C., Aliyeva, E., Bista, D., Bruch, A., Büyükmeriç, Y.,

Bukhsianidze, M., Flecker, R., Frolov, P., Hoyle, T. M., Jorissen, E. L., Kirscher, U., Koriche, S. A., Kroonenberg, S. B., Lordkipanidze, D., Oms, O., Rausch, L., Singarayer, J., Stoica, M., van de Velde, S., Titov, V. V. and Wesselingh, F. P. 2019. Quaternary time scales for the Pontocaspian domain: Interbasinal connectivity and faunal evolution. Earth-Science Reviews, 188:1-40.

Krinsley, D. B. 1970. A geomorphological and paleoclimatological study of the playas of Iran. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. Part I:xxiv + 329 pp., Part II:4 plates, 155 figures, 17 tables, 4 appendices.

Krupp, F. 1983. Fishes of Saudi Arabia. Freshwater Fishes of Saudi Arabia and Adjacent Regions of the Arabian Peninsula. Fauna of Saudi Arabia, 5:568-636.

Krupp, F. 1984. Recent changes in the distribution of Syrian freshwater fishes. Roczniki Nauk Rolniczych, seria H, 100(3)(1983):79-88.

Krupp, F. 1985a. Rehabilitation of *Barbus lorteti* Sauvage, 1882, and comments on the validity of the generic names *Bertinius* Fang, 1943, and *Bertinichthys* Whitley, 1953 (Pisces: Cyprinidae). Hydrobiologia, 120(1):63-68.

Krupp, F. 1985b. *Barbus chantrei* (SAUVAGE 1882), a valid species of cyprinid fish from the northern Levant (Pisces: Osteichthyes: Cyprinidae). Senckenbergiana biologica, 66(1/3):17-25.

Krupp, F. 1985c. Systematik und Zoogeographie der Süßwasserfische des levantinischen Grabenbruchsystems und der Ostküste des Mittelmeeres. Dissertation zur Erlangung des Grades "Doktor der Naturwissenschaften" am Fachbereich Biologie der Johannes Gutenberg - Universität in Mainz. 215 pp., Anhang: Abbildungen, Karten, Tabellen, 169 pp.

Krupp, F. 1985d. A new species of *Chondrostoma* from the Orontes river drainage basin of Turkey and Syria (Pisces: Osteichthyes: Cyprinidae). Senckenbergiana biologica, 66(1/3):27-33.

Krupp, F. 1987. Freshwater ichthyogeography of the Levant, pp. 229-237. In: Krupp, F., Schneider, W. and Kinzelbach, R. (Eds.). Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, Mainz, 1985. Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe A (Naturwissenschaften), 28, Dr. Ludwig Reichert Verlag, Wiesbaden, 338 pp.

Krupp, F. 1992. The karst springs of Ra's Al-Ain. Aqua Geõ-graphia, 1(1):26-33.

Krupp, F., Al-Hassan, L. A. J. and Ziegler, T. 1992. A possible natural hybrid of *Acanthobrama marmid* and *Alburnus mossulensis* from Haur al-Hammar, southern Iraq. Senckenbergiana biologica, 72(4/6):219-223.

Krupp, F. and Schneider, W. 1989. The fishes of the Jordan River drainage basin and Azraq Oasis. Fauna of Saudi Arabia, 10:347-416.

Krylov, V. I. 1984. An estimate of the effect of the Caspian seal (Pusa caspica) on fish populations. Canadian Translation of Fisheries and Aquatic Sciences, 5066:15 pp.

Krysanov, E. Yu. 1999. Karyotypes of *Varicorhinus capoeta* and *Barbus goktschaicus* (Cypriniformes) from Lake Sevan, Armenia. Journal of Ichthyology, 39(2):187-189.

Kuchekian, A. 1989. Fish and Fishery in Iran. Parvaneh Publications, Tehran. 45 pp. In Farsi.

Küçük, F., Bektaş, Y., Güçlü, S. S. and Kaya, C. 2014. The systematic position of *Acanthalburnus microlepis* (De Filippi, 1863) and contributions to the genus *Acanthobrama* (Cyprinidae: Leuciscinae) in Turkey. Iranian Journal of Ichthyology, 1(2):96-105.

Küçük, F., Turan, D., Güçlü, S. S., Mutlu, A. G. and Çiftci, Y. 2017. Two new species of *Chondrostoma* Agassiz, 1832 (Teleostei: Cyprinidae) from the Ceyhan, Seyhan and Göksu Rivers in the East Mediterranean Region of Turkey. Turkish Journal of Fisheries and Aquatic Sciences 17(4):793-801.

Kuliev, Z. M. 1988. Morphometric and ecological characteristics of Caspian vimba, Vimba vimba persa. Journal of Ichthyology, 28(2):56-64.

Kuliev, Z. M. 1989. Ryby Zaliva Kirova Kaspiiskogo Morya (sistematika, biologiya, promysel) [Fishes of Kirova Bay Caspian Sea (systematics, biology, fisheries)]. Akademiya Nauk Azerbaidzhanskoi SSR, Instituta Zoologii, Baku. 183 pp.

Kuliyev, Z. M. 1984. Variation of morphometric indices in Caspian vobla, Rutilus rutilus caspicus. Journal of Ichthyology, 24(6):139-148.

Kuliyev, Z. M. and Agayarova, A. E. 1984. Ecological-morphometrical characteristics of wild carp, *Cyprinus carpio* (Cyprinidae), of the Central and Southern Caspian. Journal of Ichthyology, 24(3):9-17.

Kuljanishvili, T., Epitashvili, G., Freyhof, J., Japoshvili, B., Kalous, L., Levin, B., Mustafayev., N., Ibrahimov, S., Pipoyan. S. and Mumladze, L. 2020. Checklist of the freshwater fishes of Armenia, Azerbaijan and Georgia. Journal of Applied Ichthyology, 36(4):501-514.

Kullander, S. O., Fang, F., Delling, B. and Åhlander, E. 1999. The fishes of the Kashmir Valley, pp. 99-167. In: Nyman, L. (Ed.). River Jhelum, Kashmir Valley. Impacts on the aquatic environment. Swedmar, Göteborg.

Kurdistani, S. M. and Bajestan, M. S. 2004. Rehabilitation for exist (*sic*) fishway of Jaeezan diversion dam and find a possibility for installing a fishway at exist (*sic*) Behbahan diversion dam in Iran. World Water Congress 2004, Critical Transitions in Water and Environmental Resources Management, World Water and Environmental Resources Congress 2004, 27 June - 1 July Salt Lake City, ASCE (American Society of Civil Engineers), Reston, Virginia. 7 pp.

Kürkçüoğlu, N. and Öz, G. 1989. Psoriasis and the doctor fish. The Lancet, 2(8676):1394.

Kuros, G-R. 1943. Irans Kampf um Wasser. Die Vergangenheit und ihre Lehren, die Zukunft und ihre Aufgaben in der iranischen Wasserwirtschaft. Springer-Verlag, Berlin. viii + 93 pp.

Kuru, M. 1971. The fresh-water fish fauna of eastern Anatolia. Istanbul Üniversitesi Fen Fakültesi Mecmuasi, B, 36(3-4):137-147.

Kuru, M. 1975.Dicle-Fırat Kura-Aras, Van Gölü ve Karadeniz Havzası tatlısularında yaşayan Balıkların (Pisces) Sistematik ve Zoocoğrafik Yönden İncelenmese. Docentliktezi-Basilmamis, Atatürk Üniversitesi, Erzurum.

Kuru, M. 1978-1979. The fresh water fish of south-eastern Turkey - 2 (Euphrates-Tigris system). Hacettepe Bulletin of Natural Sciences and Engineering, 7-8:105-114.

Kuru, M. 1980a. Key to the inland water fishes of Turkey. Parts I-III. Hacettepe Bulletin of Natural Sciences and Engineering, 9:103-112; 113-122; 123-133.

Kuru, M. 1980b.Türkiye Tatlısu Balıkları Kataloğu. Hacettepe Üniversitesi Fen Fakültesi Yayınları Yardımcı Kitapler Dizisi, 1:vii + 73 pp. (Seri:12, Bölüm:1, Sayı:1).

Kuru, M. 1981. Revision of *Chondrostoma* species of Turkey. Hacettepe Bulletin of Natural Sciences and Engineering, 10:111-112.

Kuru, M. 1987. Vertebrate Animals. Atatürk Űniversitesi Yayınları, Erzurum. 435 pp. In Turkish.

Kuru, M. 2004. Türkiye İçsu Balıklarının Son Sistematik Durumu (Recent systematic status of

inland water fishes of Turkey). Gazi Üniversitesi, Gazi Eğitim Fakültesi Dergisi, 24(3):1-21.

Kuru, M., Yerli, S. V., Mangit, F., Ünlü, E. and Alp, A. 2014. Fish biodiversity in inland waters of Turkey. Journal of Academic Documents for Fisheries and Aquaculture, 3:93-120.

Kushnarenko, A. I. 1978. The minimum commercial size and natural mortality of the north Caspian roach, Rutilus rutilus caspicus. Journal of Ichthyology, 18(6):886-895.

L

Ladiges, W. 1960. Süßwasserfische der Türkei, 1. Teil Cyprinidae. Mitteilungen aus dem or only hamburgischen Zoologischen Museum und Institut, 58:105-150.

Ladiges, W. 1966. Süßwasserfische der Türkei, 4. Teil: Die Gattung *Chondrostoma* (Cyprinidae) in der Türkei. Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut, 63:101-109.

Ladiges, W. and Vogt, D. 1979. Die Süßwasserfische Europas bis zum Ural und Kaspischen Meer. Verlag Paul Parey, Hamburg und Berlin. 299 pp.

Laessøe, J. 1951. The irrigation system at Ulhu, 8th century B.C. Journal of Cuneiform Studies, 5(1):21-32.

Lagounov, I. I., Podsevalov, V. N. and Skvortsov, I. K. 1933. Matériaux de l'Expédition iranienne de recherches scientifiques de la pêche en 1932-1933. MS. In Russian.

Lajbner, Z. Kohlmann, K., Linhart, O. and Kotlík, P. 2010. Lack of reproductive isolation between the Western and Eastern phylogroups of the tench. Reviews in Fish Biology and Fisheries, 20(3):289-300.

Lal Shah, S. 2010. Hematological changes in *Tinca tinca* after exposure to lethal and sublethal doses of mercury, cadmium and lead. Iranian Journal of Fisheries Sciences, 9(3):434-443.

Laloei, F. 2006. Hydrology and hydrobiology and environmental pollutions in lower than 10 meters depth of Caspian Sea. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Sari. http://en.ifro.ir (abstract).

Laloei, F. 2016. Investigation of genetic marker (luciferase gene) production for detection and stigmatize *Cyprinus carpio* or *Rutilus frisii kutum*. Iranian Fisheries Science Research Institute, Tehran. 58 pp. In Farsi.

Laloie, F., Resvani Gilkolaei, S. and Pourkazemi, M. 2003. Genetic variation of *Barbus capito* in the southern Caspian Sea by PCR-RFLP method. Iranian Scientific Fisheries Journal, 12(1):117-130, 9. In Farsi.

Laloie, F., Rezvani Gilkolaei, S. and Taghavi, M. 2015. Investigation of common carp (*Cyprinus carpio*) genetic diversity in Iranian waters of the Caspian Sea by microsatellite markers. Journal of Fisheries, 68(1):129-138. In Farsi.

Laloie, F., Rezvani Gilkolaei, S. and Taghavi, M. J. 2013. Genetic diversity and differentiation of common carp (*Cyprinus carpio* L.) in the southern part of the Caspian Sea by using microsatellite markers. Asian Fisheries Science, 26(2):115-127.

Laloei, F., Yousefian, M., Pourgholam, R., Rezvani Gilkolaei, S., Ghorghi, A., Fazli, H., Taghavi, M. J., Taleshian, H., Behreozi, Sh. and Molaei, H. 2016. Identification genetic characterization and population of *Barbus brachycephalus caspius*, *Lucioperca lucioperca*, *Rutilus rutilus caspius*, *Rutilus frisii kutum* and *Salmo trutta caspius* in southern part of the Caspian Sea by molecular method (Microsatellites) and formation

DNA bank. Iranian Fisheries Science Research Institute, Tehran. 82 pp. In Farsi.
Lalouie, F. 1993. Hydrobiological survey of Gorgan-Bay. Iranian Fisheries Bulletin, (4):53-68, 5. In Farsi.
Laluie, F. 1996. The study of bio-environmental effects of Neka Power Plant. Iranian Fisheries Scientific Journal, 4(4):14-24, 2. In Farsi.
Lamb, H. H. 1977. Climate, present, past and future. Volume 2. Climatic history and the future. Methuen, London. xxx + 835 pp.
Lamb, H. H. 1982. Climate, history and the modern world. Methuen, London. xix + 387 pp.
Lambeck, K. 1996. Shoreline reconstructions for the Persian Gulf since the last glacial maximum. Earth and Planetary Science Letters, 142(1):43-57.
Lambton, A. K. S. 1953. Landlord and Peasant in Persia. A Study of Land Tenure and Land Revenue Administration. Oxford University Press, London. xxxi + 459 pp., map.
Lambton, A. K. S. 1969. Landlord and peasant in Persia. A study of land tenure and land revenue administration. Oxford University Press, Oxford. xxxvii + 459 pp.
Landsberger, B. 1962. Materialien zum Sumerischen Lexikon. MSL VIII/2. The Fauna of Ancient Mesopotamia. Second Part. HAR-ra=hubullu Tablets XIV and XVIII. Pontificium Institutum Biblicum, Roma. x + 180 pp.
Lane, F. B. 1920. Large carp from Mesopotamia. Journal of the Bombay Natural History Society, 27(1):176-177.
Laptev, M. K. 1934. Materialy k poznaniyu fauny pozvonochnykh Turkmenistana (Bol'shie Balkhany i zapadnyi Kopet-Dag) [Materials to the knowledge of the vertebrate fauna of Turkmenistan (Great Balkhan and western Kopet-Dag)]. Izvestiya Turkmenskogo mezhduvedomstvennogo Komiteta po okhrane prirody i razvitiyu prirodnykh bogatstv, Ashkhabad, 1:154-165.
Larijani, M., Noroozi, M., Enayat Gholampour, T. and Sedaqat, S. 2013. Survey on haplotype distribution due to digestion of the PCR product in common carp *Cyprinus carpio* from southern coast of the Caspian Sea using cytochrome oxidase. Breeding and Aquaculture Sciences Quarterly, 1(2):79-88. In Farsi.
Larsen, C. E. 1975. The Mesopotamian delta region: a reconsideration of Lees and Falcon. Journal of the American Oriental Society, 95(1):43-57.
Larsen, C. E. and Evans, G. 1978. The Holocene geological history of the Tigris-Euphrates-Karun Delta, pp. 227-244.In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.
Lasheidani, M. F., Balouchi, S. N., Keyvan, A., Jamili, S. and Falakrou, K. 2008. Effects of butachlor on density, volume and number of abnormal sperms in Caspian kutum (*Rutilus frisii kutum* Kamenskii 1901). Research Journal of Environmental Sciences, 2(6):474-482.
Latifi, N., Hashemzadeh Segherloo, I., Ashrafzadeh, M. and Rahimi, R. 2018. Analysis of phylogenetic relationships of *Schizothorax zarudnyi* and *Schizothorax pelzami* using COI sequence. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Latifi, N., Hashemzadeh Segherloo, I., Sheikh, Y. and Ashrafzadeh, M. R. 2018. Identification of fishes in Chahnimeh water reservoirs of Zabol (Iran) via COI sequences. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Lebria, A., Khoshkholgh, M. and Falahatkar, B. 2020. The effect of using different levels of

olive pomace on growth performance and hematological indices of goldfish (*Carassius auratus*). Journal of Animal Environment, 12(1):315-322. In Farsi.
Lees, G. M. and Falcon, N. L. 1952. The geographical history of the Mesopotamian Plains. Geographical Journal, 118(1):24-39.
Lehner, E. 1944. The Persian salt formations. Proceedings of the National Academy of Sciences India, 14(6), Section B:249-258.
Lelek, A. 1987. The Freshwater Fishes of Europe. Volume 9. Threatened Fishes of Europe. AULA-Verlag, Wiesbaden. 343 pp.
Lever, C. 1996. Naturalized Fishes of the World. Academic Press, London. xxiv + 408 pp.
Levin, B., Thoni, R., Artaev, O., Bolotovskiy, A., Levina, M., Rasulov, A., Mirzoev, N. and Simonov, E. 2019. Morphological and mtDNA data reveal broader distribution of *Alburnoides holciki* (Teleostei: Cyprinidae) in inland waters of Central Asia. Zootaxa, 4614(1):117-126.
Levin, B. A. 2004. Phenetic relationship of barbels of the Caucasian region and their status in the system of the genus *Barbus* sensu stricto (Cyprinidae). Journal of Ichthyology, 44(6):444-449.
Levin, B. A., Freyhof, J., Lajbner, Z., Perea, S., Abdoli, A., Gaffaroğlu, M., Özulug, M., Rubenyan, H. R., Salnikov, V. B. and Doadrio, I. 2012. Phylogenetic relationships of the algae scraping cyprinid genus *Capoeta* (Teleostei: Cyprinidae). Molecular Phylogenetics and Evolution, 62(1):542-549.
Levin, B. A., Gandlin, A. and Barmintseva, A. 2015. Genetic revision of Caucasian barbels, the genus Barbus: one species plus, one species minus. XV European Congress of Ichthyology, Porto, Portugal, 7-11 September, 2015 (poster).
Levin, B. A., Gandlin, A. A., Simonov, E. S., Levina, M. A., Barmintseva, A. E., Japoshvili, B., Mugue, N. S., Mumladze, L., Mustafayev, N. J., Pashkov, A. N., Roubenyan, H. R., Shapovalov, M. I. and Doadrio, I. 2019. Phylogeny, phylogeography and hybridization of Caucasian barbels of the genus *Barbus* (Actinopterygii, Cyprinidae). Molecular Phylogenetics and Evolution, 135:31-44.
Levin, B. A., Prokofiev, A. M. and Roubenyan, H. R. 2019. A new species of algae eaters *Capoeta kaput* sp. nov. (Teleostei, Cyprinidae) from Transcaucasia. Inland Water Biology, 12(1):32-41.
Levin, B. A., Rubenyan, A. R. and Salnikov, V. B. 2005. Phenetic diversity of khramulya *Capoeta capoeta* (Ostariophysi, Cyprinidae). Journal of Ichthyology, 45(9):754-767.
Levin, B. A., Simonov, E., Matveyev, M. P., Artaev, O. N., Mustafayev, N. J., Pashkov, A. N. and Roubenyan, H. R. 2018. DNA barcoding of the fishes of the genus *Alburnoides* (Actinopterygii, Cyprinidae) from Caucasus. Mitochondrial DNA Part A, 29(1):49-55.
Levin, B. A., Simonov, E. P., Ermakov, O, A., Levina, M. A., Interesova, E. A., Kovalchuk, O. M., Malinina, Y. A., Mamilov, N. S., Mustafayev, N. J., Pilin, D. V., Pozdeev, I. V., Prostakov, N. I., Roubenyan, H. R., Titov, S. V. and Vekhov, D. A. 2017. Phylogeny and phylogeography of the roaches, genus *Rutilus* (Cyprinidae), at the eastern part of its range as inferred from mtDNA analysis. Hydrobiologia, 788(1):33-46.
Leviton, A. E., Gibbs, R. H., Heal, E. and Dawson, C. E. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia, 1985(3):802-832 (see www.asih.org/ for latest version).
Lewis, A. and Nazaridoust, A. 2016. Iran wetlands: Development needs and conservation

management, pp. 16-31. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Li, J., Wang, X., Kong, X., Zhao, K., He, S. and Mayden, R. L. 2008. Variation patterns of the mitochondrial 16S rRNA gene with secondary structure constraints and their application to phylogeny of cyprinine fishes (Teleostei: Cypriniformes). Molecular Phylogenetics and Evolution, 47(2):472-487.

Li, X. and Guo, B. 2020. Substantially adaptive potential in polyploid cyprinid fishes: evidence from biogeographic, phylogenetic and genomic studies. Proceedings of the Royal Society, B, 287:20193008.

Liao, T-Y., Ünlü, E. and Kullander, S. O. 2011. Western boundary of the subfamily Danioninae in Asia (Teleostei, Cyprinidae): derived from the systematic position of *Barilius mesopotamicus* based on molecular and morphological data. Zootaxa, 2880(1):31-40.

Liaqati, M. B. 1997. A passing glance at the appearance and extension of quanats (aqueducts). Farhang-e Jihad (Construction Crusade Culture Quarterly), Spring and Summer, 1997(3 & 4) (www.netiran.com/Htdocs/Clippings/Social/970700XXSO01.html).

Libosvárský, J. 1962. Zur palaeoborealen Verbreitung der Gattung *Carassius* Jarocki 1822. Zoologische Jahrbücher Abteilung für Systematik Öekologie und Geographie der Tiere, Jena, 90:197-210.

Light, W. A. 1917. A large carp from the Euphrates River. Journal of the Bombay Natural History Society, 25(2):308-309.

Lindberg, G. U. and Heard, A. S. 1972. Slovar nazvanii presnovodnikh ryb SSSR na yazikakh narodov SSSR i evropeiskikh stran [Dictionary of the Names of Freshwater Fishes of the USSR on the Languages of the Peoples of the USSR and European Countries]. Izdatel'stvo Nauka, Leningrad. 367 pp.

Liravi, F., Salati, A. M., Asadi, F. and Pasha Zanoosi, H. 2014. Alterations in antioxidant defence in the early life stages of silver carp, *Hypophthalmichthys molitrix*. Progress in Biological Sciences, 4(2):179-187.

Liška, L. and Pivnička, K. 1985. Morphologische Variabilität von drei Arten der Ukeleie (Alburnus alburnus, A. albidus, A. charusini) (Pisces: Cyprinidae). Věstník československé Společnosti zoologické, 49(2):111-122.

Liu, J., Jiang, J., Song, S., Tornabene, L., Chabarria, R., Naylor, G. J. P. and Li, C. 2017. Multilocus DNA barcoding - species identification with multilocus data. Scientific Reports, 7:16601.

Löffler, H. 1956. Ergebnisse der Österreichischen Iranexpedition 1940/50: Limnologische Beobachtung an Iranischen Binnengewässern. Hydrobiologia, 8(3-4):201-278.

Löffler, H. 1957. Limnological investigations in Southern Persia especially concerning the shallow salt lakes of the country. Year Book of the American Philosophical Society, 1957:242-244.

Löffler, H. 1959. Beiträge zur Kenntnis der Iranischen Binnengewässer. I. Der Nirizsee und sein Einzugsgebiet. Internationale Revue der Gesamten Hydrobiologie, 44(1-4):227-276.

Löffler, H. 1961. Beiträge zur Kenntnis der Iranischen Binnengewässer. II. Regional-limnologische Studie mit besonderer Berücksichtigung der Crustaceenfauna. Internationale Revue der Gesamten Hydrobiologie, 46(3):309-406.

Löffler, H. 1968. The hydrobiology of Lake Niriz, Iran. Proceedings of a Technical Meeting on Wetland Conservation, Ankara-Bursa-Istanbul, 9 to 16 October 1967, International Union for Conservation of Nature and Natural Resources Publication, new series, 12:141-151.

Löffler, H. 1981. The winter condition of Lake Niriz in Southern Iran. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 21(1):528-534.

Löffler, H. 1993. The future of large lakes in the third world. Memorie dell'Istituto Italiano di Idrobiologia, 52:27-38 (In: de Bernardi, R., Pagnotta, R. and Pugnetti, A. (Eds.). 5th International ILEC Conference, Stresa '93 "Strategies for lake ecosystems beyond 2000" Selected papers. 400 pp.).

Lönnberg, E. 1900a. Contributions to the ichthyology of the Caspian Sea. Kunglica Svenska Vetenskapsakademiens Handlingar, 26, IV(8):3-38. Vestnik Rybopromyshlennosti, St. Petersburg, 16:30-39.

Lönnberg, E. 1900b. Short notes on Caspian fishes. Revue Internationale de Pêche et de Pisciculture, St. Petersbourg, 2(2):3-6.

Lortet, L. 1883. Études zoologiques sur la Faune du Lac de Tibériade suivies d'un aperçu sur la faune des lacs d'Antioche et de Homs. I. Poissons et reptiles du lac de Tibériade et de quelques autres parties de la Syrie, pp. 99-180. Poissons de Syrie recueillis par M. Ernest Chantre en 1881 pendant son mission scientifique en Mésopotamie, dans l'Armenie et le Kurdistan, pp. 181-182. Archives du Museum d'Histoire naturelle de Lyon, 3:99-182, plates vi-xviii.

Lotfi, A. 2010. Lake Parishan. A concise baseline report. Conservation of Iranian Wetlands Project, Saving Wetlands for People, and Nature. Department of Environment, United Nations Development Programme and Global Environment Facility. viii + 90 pp.

Lotfi, A. 2018a. Lake Parishan (Islamic Republic of Iran). In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Lotfi, A. 2018b. Lake Uromiyeh (Islamic Republic of Iran). In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Lotfi, A. 2018c. Shadegan Wetland (Islamic Republic of Iran). In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Loukhi, T., Harsij, M., Kolangi Miyandareh, H. and Ghafari Farsani, H. 2015. Effect of dietary nucleotides on hematological and serum biochemical parameters of juvenile common carp (*Cyprinus carpio*). Aquatic Physiology and Biotechnology, 3(3):51-62. In Farsi.

Loukhi, T., Harsij, M., Kolangi Miyandareh, H. and Jafariyan, H. 2015. Effect of dietary nucleotides on growth, survival and some hematological parameters of common carp (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 9(3):69-78. In Farsi.

M

Maaboodi, H., Jamili, S. and Maddani, H. 2011. Accumulation of heavy metals (lead and zinc) in the liver of some edible fishes in Zayandeh-rood. Research Journal of Environmental Sciences, 5(3):295-301.

Maafi, A. 1996a. Parishan Lake, second registered Iranian Lagoon in Ramsar Convention. Abzeeyan, Tehran, 7(4):14-16, V. In Farsi.

Moafi (Maafi), A. 1996b. Parishan Lake, second registered Iranian lagoon in Ramsar Convention. Abzeeyan, Tehran, 7(5):15-17, III. In Farsi.

Maafi, S. A. 1996c. Parishan Lake, and human role on its ecological balance. Abzeeyan, Tehran, 7(6):7-9, 17, III. In Farsi.
Mabudi, H. 2011. Histology and hormonal effect of ghrelin on ovary of benni (*Barbus sharpeyi*) in order to study sexual maturity, zygote and larval generation. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 127 pp. In Farsi.
Mabudi, H., Jamili, S., Majd, N. E., Vosoughi, G., Fatemi, M. R. and Rashed, S. 2011. The effects of ghrelin on ovary histology in *Barbus sharpeyi*. Journal of Animal Physiology and Animal Nutrition, 95(5):599-602.
Mabudi, H., Javadzadeh, N., Savari, A. and Taghi Ajir, M. 2019. Determination of optimum concentration of pituitary gland extract and LHRHa2 hormones in 3-stages injection based on reproduction indices of *Arabibarbus grypus*. Journal of Aquaculture Development, 13(1):141-149. In Farsi.
Mabudi, H., Savari, A. and Javadzadeh, N. 2013. The integrated effect of $LHRHA_2$ and pituitary extract on maturation of *Barbus xanthopterus*. International Journal of Marine Science and Engineering, 3(3):153-158.
MacFadyen, W. A. 1938. Water Supplies in Iraq. Ministry of Economics and Communications, Government Press, Baghdad and Iraq Geological Department Publication, 1:206 pp., + viii, XIX plates.
MacFadyen, W. A. and Vita-Finzi, C. 1978. Mesopotamia: the Tigris-Euphrates delta and its Holocene Hammar Fauna. Geological Magazine, 115(4):287-300.
MacFarquhar, N. 2001. Drought chokes off Iran's water and its economy. The New York Times on the Web, 3 pp. (www.climateark.org/articles/2001/3rd/drchoffi.htm, downloaded 9 March 2003).
Machacek, H. 1983-2012. World Records Freshwater Fishing, www.fishing-worldrecords.com.
Machanlu, M., Ziaei Nejad, S., Banaei, M. and Johari, S. A. 2017. Influence of nanoparticles titanium dioxide and oil-soluble phase under UV radiation and darkness on growth indices of common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(4):189-194. In Farsi.
Machordom, A. and Doadrio, I. 2001. Evidence of a Cenozoic Betic-Kabilian connection based on freshwater fish phylogeography (*Luciobarbus*, Cyprinidae). Molecular Phylogenetics and Evolution, 18(2):252-263.
Mackay, H. 1919. Large carp from Mesopotamia. Journal of the Bombay Natural History Society, 26(2):680.
MacMahon, H. 1906. Recent survey and exploration in Seistan. Geographical Journal, 28(3):209-228, 333-352, map p. 312.
Madani, E., Moshfegh, A., Setorki, M. and Tehranifard, A. 2020. Effects of roundup pesticides on gonadosomatic index and histopathologic changes in gill and testis of common carp (*Cyprinus carpio*). Journal of Experimental Animal Biology, 8(4):21-31. In Farsi.
Madani, K. 2014. Water management in Iran: what is causing the looming crisis? Journal of Environmental Studies and Science, 4(4):315-328.
Madani, K., AghaKouchak, A. and Mirchi, A. 2016. Iran's socio-economic drought: challenges of a water-bankrupt nation. Iranian Studies, 49(6):997-1016.
Madbaygi, S. 1992. A review of fisheries in Mazandaran. Abzeeyan, Tehran, 2:40-43. In Farsi.
Madbaygi, S. 1993a. A brief review of the Mollasani Research Centre for Freshwater Fish Culture. Abzeeyan, Tehran, 4(11):39-41. In Farsi.
Madbaygi, S. 1993b. Gharasoo Research Station, pioneer in fisheries applied research projects.

Abzeeyan, Tehran, 4(5):38-42, III. In Farsi.
Maghsoudi, A., Vanaei, M. and Yazdi, M. 2015. Heavy metal pollution in stream sediments of the Neka River, N. Iran. Journal of Geosciences, 24(95):167-174. In Farsi.
Maghsoudloo, T., Pazira, A., Sadegh Panahi, Z. and Meghdadi, S. 2013. Fish species biodiversity in Khan Creek and Mond estuary. Journal of Marine Biology, 5(2):81-91. In Farsi.
Maghsoudlou, T., Mousavi, S. A. A. M. and Fakhri, A. 2010. Reproductive characteristics of the large scaled barb in the Shapoor River in Boushehr Province. Journal of Fisheries, 4(3)(15):117-122. In Farsi.
Mahboobi, M. and Hasanabadi, N. 2014. An investigation on barriers to warm water fish culture from point of view of aquaculturalist in Golestan Province. Journal of Utilization and Cultivation of Aquatics, 3(2):121-130. In Farsi.
Mahboobi Soofiani, N., Farhadian, O., Mohammadi, M. and Malekpouri, P. 2015. Effect of temperature on metabolic rate of *Chondrostoma rejium* (*sic*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 238.
Mahboobi Soofiani, N., Pooramini, M., Asadollah Nasrabadi, S., Ahamdi, S. and Hatami, R. 2014. Age, growth and reproduction of *Chondrostoma regium* (Heckel, 1843) from the Zayandeh Roud River, Iran. Iranian Journal of Fisheries Sciences, 13(4):810-822.
Mahdavi, M. and Anderson, E. W. 1983. The water-supply system in the margin of Dasht-e-Kawir (Central Iran). Bulletin of the British Society for Middle Eastern Studies, 10(2):131-145.
Mahdavi, S., Yeganeh, S., Firouzbakhsh, F. and Janikhalili, Kh. 2014. Effects of supplementary fennel (*Foeniculum vulgare*) essential oil of diet on growth, survival, body composition and hematological parameters of *Rutilus frisii kutum*. Journal of Fisheries Science and Technology, 3(3):79-90. In Farsi.
Mahdavi, S., Yeganeh, S., Firouzbakhsh, F. and Janikhalili, Kh. 2017. Effects of fennel (*Foeniculum vulgare*) essential oil of diet on some biochemical parameters and salinity stress resistance of kutum (*Rutilus kutum*) fry. Iranian Scientific Fisheries Journal, 25(4):1-16. In Farsi.
Mahdi, N. 1962. Fishes of Iraq. Ministry of Education, Baghdad. 82 pp.
Mahdi, N. and Georg, P. V. 1969. A systematic list of the vertebrates of Iraq. Iraq Natural History Museum Publication, Baghdad, 26:1-104.
Mahdipoor, M., Barzegar, M. and Jalali, B. 2004. Monogenean parasites of fishes in Zayandeh-rud River. Iranian Journal of Veterinary Sciences, 1(2):19-28. In Farsi.
Mahghani, F., Gharaei, A., Ghaffari, M. and Akrami, R. 2014. Dietary synbiotic improves growth performance, survival and innate immune response of gibel carp (*Carassius auratus gibelio*) juveniles. International Journal of Aquatic Biology, 2(2):99-104.
Mahjoorazad, A. and Coad, B. W. 2009. A new cave fish locality for Iran. Electronic Journal of Ichthyology, 5(2):30-33.
Mahjoorian, A., Saeedi Asl, M. R., Jafarian, S., Taha Nezhad, M. and Golei Zadeh, B. 2020. Optimization of extraction conditions of gelatin from Caspian whitefish (*Rutilus frisii kutum*) scale. Iranian Journal of Food Science and Technology, 16(95):111-125. In Farsi.
Mahjoorian, A., Saeedi Asl, M. R., Rezaei, M., Mortazavi, S. A. and Ariaii, P. 2018. Physico-mechanical and antimicrobial properties of edible film incorporated with *Caryophillum*

aromaticus essential oil (CAO) from Caspian white fish (*Rutilus frisii kutum*) scale. Journal of Food Hygiene, 8(3):57-71. In Farsi.

Mahmoodi, M. M. and Javanmardi, F. 2010. Determination of the amount and origin of fecal bacteria in Parishan Lake. Iranian Journal of Biology, 22(4):711-718. In Farsi.

Mahmoodi, Z., Falahatkar, B., Noverian, H. A. and Khoshkholgh, M. R. 2015. Growth and biochemistry changes of Caspian kutum (*Rutilus frisii kutum*) under different levels of dietary protein and lipid. Journal of Fisheries (Iranian Journal of Natural Resources), 68(3):479-493. In Farsi.

Mahmoodi, Z., Noverian, H., Falahatkar, B. and Khoshkholgh, M. R. 2012. Growth and feed utilization of Caspian kutum *Rutilus frisii kutum*, fed diets containing different protein and fat levels. Aqua 2012, 1-5 September 2012, Prague (title).

Mahmoodi, Z., Noverian, H. A., Falahatkar, B. and Khoshkholgh, M. R. 2012. Effect of diet protein and fat ratio on growth and physiological changes of Caspian kutum (*Rutilus frisii kutum*, Kamenskii, 1901). The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 379-384.

Mahmoudi, N., Abedi, H. and Falahatkar, B. 2010. Effect of various dietary nucleotide on some biochemical and hematological parameters of common carp (*Cyprinus carpio*) juveniles. Journal of Marine Sciences and Technology, 9(3):4-12. In Farsi.

Mahmoudi Khoshdarehgi, M., Haji Moradloo, A. and Dastar, B. 2018. Investigating water quality and growth of *Cyprinus carpio* fingerlings fed with different protein levels of diet in biofloc system. Journal of Animal Environment, 10(3):191-198. In Farsi.

Mahmoudi Khoshdarehgi, M., Haji Moradloo, A. and Dastar, B. 2019. Determining the appropriate level of protein in the diet of *Cyprinus carpio* fry based on some parameters of growth, blood and serum biochemistry in biofloc system. Journal of Applied Ichthyological Research, 7(1):61-84. In Farsi.

Mahmoudi Rad, H. 2011. Shadegan Wetland integrated management plan. UNDP/GEF/DOE Conservation of Iranian Wetlands Project in cooperation with Khuzestan Environment Conservation Office. 40 pp.

Mahmoudian, A., Keramat Amirkolaei, A., Akrami, R. and Bahalkeh, A. 2015. Investigating the effect of prebiotic alphamune and probiotic protexin in separation and/or in combination growth performance of juvenile common carp (*Cyprinus carpio* Linnaeus, 1758). Journal of Applied Ichthyological Research, 3(1):93-104. In Farsi.

Mahmoudifard, A. 2015. Use of benthic invertebrates population structure and distribution pattern for biological monitoring and water quality assessment in Shahrud river (Qazvin Province). Journal of Utilization and Cultivation of Aquatics, 3(4):91-108. In Farsi.

Maitland, P. S. 1991. Conservation of threatened freshwater fish in Europe. Convention on the Conservation of European Wildlife and Natural Habitats, Nature and Environment Series, Council of Europe Press, Strasbourg, 46:1-76.

Majdzadeh, M. 1987. Collection and identification of fishes in Radkan and Frizy tributaries: Unpublished Honours B.Sc. Thesis, Biology Department, Mashhad University, Mashhad, Iran.

Majeed, S. U., Feulner, G. R. and Al Hmoudi, A. H. 2019. *Garra barreimiae* Fowler & Steinitz, 1956 (Cyprinidae: Labeoninae): A video record of individuals scaling the main waterfall in Wadi Wurayah National Park, Fujairah. Tribulus, 27:42-45.

Majlesi, M., Pashangeh, S., Salehi, S. O. and Berizi, E. 2018. Human health risks from heavy metals in fish of a fresh water river in Iran. International Journal of Nutrition Sciences, 3(3):157-163.
Majnoni, F., Alipour, H., Hassanpour, M., Banagar, G. and Ajorlo, M. 2015. Assessment of Cd, Cr and Pb pollution in sediment and water of Gheshlagh River, Iran, in September 2013. Iranian Journal of Toxicology, 9(28):1264-1270.
Majnoni, F., Mansouri, B., Rezaei, M. and Hamidian, A. H. 2013. Metal concentrations in tissues of common carp, *Cyprinus carpio* and silver carp, *Hypophthalmichthys molitrix* from the Zarivar Wetland in western Iran. Archives of Polish Fisheries, 21(1):11-18.
Majnunian, H. 1985. National Parks and Natural Reserves. Environmental Studies, Tehran University Press, 12:10-14. In Farsi.
Makeeva, A. P. and Pavlov, D. S. 2000. Morphological characteristics and main features for the identification of pelagic eggs of freshwater fish of Russia. Journal of Ichthyology, 40(9):740-750.
Makeyeva, A. P. and Mokhamed, M. I. Z. 1982. The reproduction and development of Pseudorasbora parva in Soviet Central Asia. Journal of Ichthyology, 22(1):69-82.
Makhdoum, M. 2014. An overview of the state of the environment of Iran (conditions & trends). Environmental Researches, 4(8):37-42. In Farsi.
Makhlough, A., Nasrollahzadeh, H., Parafkandeh, F., Fazli, H., Mirzaei, R., Hosseinpour, H., Keihansani, A. R. and Doostdar, M. 2017. Monitoring water quality and eutrophication phenomenon of Azad Dam using Iranian Water Quality Index and Carlson’s Trophic State Index. Iranian Scientific Fisheries Journal, 26(2):69-78. In Farsi.
Makhlough, A., Nasrollahzadeh Saravi, H., Eslami, F. and Mosavi, M. 2014. Ecobiological study of Mazandaran coastal water of the Caspian Sea (2012-2013). Journal of Oceanography, 5(19):35-44. In Farsi.
Makhlough, M., Shahsavani, D. and Kazerani, H. R. 2011. Blood serum electrolyte and non-electrolyte parameters in breeding *Rutilus frisii kutum* Kamensky. Journal of Veterinary Research, 67(1):53-58. In Farsi.
Makhmudbekov, A. 1940. K sistematike kaspiiskoi shemai [On the systematics of the Caspian shemaya]. Izvestiya Azerbaidzhanskoi rybokhozyaistvennoi stantsii, 1940(5):3-16.
Makki, T., Mostafavi, H., Matkan, A. and Aghighi, H. 2021. Modelling climate-change impact on the spatial distribution of *Garra rufa* (Heckel, 1843) (Teleostei: Cyprinidae). Iranian Journal of Science and Technology, Transactions A, 45:795-804.
Maksunov, V. A. 1971. Non-annual spawning of some fishes of Soviet Central Asia. Journal of Ichthyology, 11(2):192-198.
Maktabi, P., Javaheri Baboli, M., Jafarnejadi, A. R. and Askary Sary, A. 2015. Mercury concentrations in common carp (*Cyprinus carpio*) tissues, sediment and water from fish farm along the Karoun River in Iran. Veterinary Research Forum, 6(3):217-221.
Maktabi, P., Mohammadiazarm, H., Peyghan, R., Mohammad Mousavi, S. and Zarei, M. 2019. Effect of formic acid, potassium di format and formic acid nano-chitosan solution on survival, growth indices and body composition of common carp (*Cyprinus carpio*). Journal of Wetland Ecobiology, 10(4):41-54. In Farsi.
Maktabi, P. and Romiani, L. 2016. Comparison of iron concentration in the muscle, liver and gill of farmed common carp (*Cyprinus carpio*), in the warm water fish ponds of Khuzestan Province of I. R. Iran. Iranian Scientific Fisheries Journal, 25(2):135-142. In Farsi.
Maktabi, S., Fazlara, A. and Ebrahimian, S. 2011. Incidence of *Listeria* species in farmed

tropical fish in Khuzestan, Iran. World Journal of Fish and Marine Sciences, 3(3):206-209.

Makvandi, H., Khodadadi, M., Keyvan Shokoh, S. and Mohammadi Makvandi, Z. 2012. Effect of salinity stress on cortisol hormone and glucose in grass carp fingerlings (*Ctenopharyngodon idella*). Journal of Aquatic Animals and Fisheries, 2(8):77-84. In Farsi.

Makvandi, H., Kodadadi, M. and Keyvanshokoh, S. 2010. Effect of salinity on growth and survival of grass carp (*Ctenopharyngodon idella*) fingerlings. Journal of Wetland Ecobiology, 1(4):51-57. In Farsi.

Makvandi, H., Makvandi, Z. and Khodadadi, M. 2012. Evaluation of optimum level NaCl bath for disinfection in fingerlings of bighead (*Aristichthys nobilis*), common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*) during transportation. Journal of Aquatic Animals and Fisheries, 3(9):81-86. In Farsi.

Malakpour Kolbadinejad, S., Hajimoradloo, A., Ghorbani, R. and Wilson, J. M. 2010. Effect of gradual increase salinity on some osmoregulatory functions in Caspian roach Rutilus rutilus caspicus in the southeast of Caspian Sea, Iran. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Malakpour Kolbadinezhad, S., Hajimoradloo, A., Ghorbani, R., Joshaghani, H. and Wilson, J. M. 2012. Effects of gradual salinity increase on osmoregulation in Caspian roach *Rutilus caspicus*. Journal of Fish Biology, 81(1):125-134.

Malek, M. 1993. Investigation on the infection of Capoeta capoeta with Clinonstomum (*sic*) and it's (*sic*) life cycle in the Shirrod River. Iranian Fisheries Bulletin, (3):45-65, 6-7. In Farsi.

Malek, M. and Mobedi, I. 2001. Occurrence of *Clinostomum Complanatum* (*sic*) (Rudolphi, 1819) (Digenea: Clinostomatidae) in *Capoeta capoeta gracilis* (Osteichthys (*sic*): Cyprinidae) from Shiroud River, Iran. Iranian Journal of Public Health, 30(3-4):95-98.

Malek, M. and Shamsi, Sh. 1994. Infection with *Clinostomum complanatum* in *Capoeta capoeta* in Shiroud River and its life cycle. Proceedings of Seminar of Fisheries Researches, Tehran University, Tehran, Iran, September 1994, pp. 31-32.

Malek-Eizadi, A. 1993. In memory of the Lar River: not a good memento. Abzeeyan, Tehran, 4(5):22-23. In Farsi.

Malek Nedjad, M. R. and Parivar, K. 1993. Influence of lead nitrate upon organogenesis of hypophthalmichthys (*sic*) molitrix. Iranian Fisheries Bulletin, (1):31-46, 6-7. In Farsi.

Maleki, A., Azadi, N. A., Mansouri, B., Majnoni, F., Rezaei, Z. and Gharibi, F. 2015. Health risk assessment of trace elements in two fish species of Sanandaj Gheshlagh Reservoir, Iran. Toxicology and Environmental Health Sciences, 7(1):43-49.

Maleki, L., Heidari, H. and Ghaderi, E. 2019. Infection of fishes to helminth parasites in Gheshlagh basins, Kurdistan Province. Journal of Animal Researches (Iranian Journal of Biology), 32(4):420-429. In Farsi.

Maleki, L., Heidari, H., Ghaderi, E. and Rostamzadeh, J. 2018. Occurrence and description of *Clinostomum complanatum* (Rudolphi, 1819) metacercariae in freshwater fishes from Gheshlagh basin, West of Iran. Iranian Journal of Animal Biosystematics, 14 (2):91-103.

Maleki, L. and Malek, M. 2007. Digenean parasites of *Capoeta capoeta* and *Chalcalburnus chalcoides* (Osteichthyes: Cyprinidae) in Shiroud River. Journal of Science, University of Tehran, 32(4)(2):369-373.

Maleki, M., Imanpour, M. R., Jafari, V. and Kalangi Miandareh, H. 2020. Effects of different

periods of starvation and compensatory growth on growth and hematological parameters in common carp (*Cyprinus carpio*). Journal of Applied Ichthyological Research, 8(1):70-79. In Farsi.

Maleki, P., Patimar, R., Jafarian, H. and Mahini, A. R. 2020. Ecological assessment of organic pollution in the Gorgan Bay, using Palmer Algal index. Iranian Journal of Applied Ecology, 9(1):45-59. In Farsi.

Malekinezhad, H., Alizadeh, A., Cheraghi, H., Meshkini, S. and Dardmeh, F. 2010. The protective effect of liquorice plant extract on CCL_4-induced hepatotoxicity in common carp (*Cyprinus carpio*). Veterinary Research Forum, 1(3):158-164.

Malekpouri, P., Kazemian, M., Moshtaghie, A. A. and Soltani, M. 2011. Short-term of cadmium on parameters related to bone metabolism in common carp (*Cyprinus carpio* L.). Journal of Fisheries, 5(1):31-38. In Farsi.

Malekpouri, P. and Mahboobi Soofiani, N. 2016. Effect of water-borne aluminum on serum parameters related to thyroid function of common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(2):199-206. In Farsi.

Malekpouri, P., Mesbah, M. and Rezaie, A. 2015. Aetiology of skeletal deformity in a *Barbus grypus* (Heckel, 1843) fish: clinical and radiological studies. Comparative Clinical Pathology, 24(1):201-206.

Malekpouri, P., Peyghan, R., Mahboobi-Soofiani, N., Herbert, N. and Mohammadian, B. 2016. The interactive effect of water-borne cadmium and environmental hypoxia on common carp (*Cyprinus carpio*) metabolism. Iranian Scientific Fisheries Journal, 24(4):87-101. In Farsi.

Malekzehi, M. H., Esmaeili, H. R., Zareian, H., Farahani, Z. and Pazira, A. 2014. Incidence of *Lernaea* (Crustacea: Copepoda) parasitic in the Mashkid River basin, southeast of Iran. International Journal of Aquatic Biology, 2(1):9-13.

Malekzehi, M. H., Zareian, H., Farahani, Z., Pazira, A. and Esmaeili, H. R. 2013. On the occurrence of *Lernaea* (Crustacea: Copepoda) parasitic on some fishes in Mashkid drainage, east of Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 84 (abstract).

Malhotra, Y. R. and Munshi, S. 1985. First feeding and survival of *Aspidoparia morar* larvae (Cyprinidae). Transactions of the American Fisheries Society, 114(2):286-290.

Mallahi, H., Hedayati, S. A. A., Hoseinifar, S. H., Jafar Nodeh, A. and Bagheri, T. 2020. Haematological response of common carp (*Cyprinus carpio*) exposed to nano silver after feeding with food supplements. Journal of Utilization and Cultivation of Aquatics, 8(4):1-10. In Farsi.

Mallek, M. 2002. Identification and study of qanat fishes in Bajestan basin. Proceedings of the First National Conference on Biodiversity, Bahonar University, Kerman, pp. 41-47.

Mallowan, M. E. L. 1964. Noah's flood reconsidered. Iraq, 26(2):62-82, pls. XVI-XX.

Maltby, E. (Ed.). 1994. An Environmental and Ecological Study of the Marshlands of Mesopotamia. Wetland Ecosystems Research Group, University of Exeter and the AMAR Appeal Trust. 228 pp.

Malvandi, H. 2021. Assessing the potential health risk from mercury through consumption of the most popular and preferable fish species, *Rutilus frisii kutum*, on the northern coast of Iran. Biological Trace Element Research, 199(4):1604-1610.

Malvandi, H., Esmaili Sari, A. and Aliabadian, M. 2014. Mercury contamination in khramulia (*Capoeta capoeta*) from the Cheshme Kile and Zarrin Gol rivers in Iran and human

health risk assessment. Bulletin of Environmental Contamination and Toxicology, 93(4):472-477.

Malvandi, H., Esmaili Sari, A. and Aliabadian, M. 2020. Genetic variability and population structure of *Capoeta gracilis* (Keyserling 1861) populations in the southern basin rivers of the Caspian Sea as revealed by the mtDNA sequences. Indian Journal of Fisheries, 67(2):35-40.

Mamaev, V. 2002. Europe's biodiversity - biogeographical regions and seas. Seas around Europe. The Caspian Sea - enclosed and with many endemic species. European Environment Agency, 25 pp. (http://reports.eea.eu.int/report_2002_0524_154909/en/CaspianSea.pdf, downloaded 11 December 2002).

Ma'manpoush, A. R. 1995. Environmental effects of hydraulic structures on aquatic life. WRM '95. Proceedings of the Regional Conference on Water Resources Management, Conference Secretariat, Isfahan University of Technology, Isfahan, p. 153.

Mamedov, A. V. 1997. The late Pleistocene-Holocene history of the Caspian Sea. Quaternary International, 41/42:161-166.

Manafi Havigh, Z., Valipouri, A. R., Javaheri, M. and Talebi Haghighi, D. 2011. Effect of replacement fish meal by soybean meal on growth and survival of kutum (*Rutilus frisii kutum*). Journal of Fisheries, 5(2):57-64. In Farsi.

Mandegari, M., Ahmadi, M. R. and Kamrani, E. 2014. A limnological investigation of water resources of the Hajiabad in the northwest of Hormozgan Province. Journal of Aquatic Animals and Fisheries, 5(18):51-63. In Farsi.

Mandel, S. 1975. Plain of Ghazvin, Iran, pp. 157-160. In: Ground-water storage and artificial recharge. Natural Resources / Water Series No. 2, Department of Economic and Social Affairs, United Nations, New York.

Mandych, A. F. (Ed.). 1995. Enclosed seas and large lakes of eastern Europe and middle Asia. SPB Academic Publishing, Amsterdam. viii + 273 pp.

Mangalo, H. H. and Akbar, M. M. 1988a. Limnological investigations on the Al-Latifiyah common carp (*Cyprinus carpio*) pond (Baghdad - Iraq). I- Environmental conditions and zooplankton abundance. Journal of Environmental Science and Health, A23(4):335-349.

Mangalo, H. H. and Akbar, M. M. 1988b. Limnological investigation on the Al-Latifiyah common carp (*Cyprinus carpio*) pond (Baghdad - Iraq). II Food and feeding habits of *Cyprinus carpio* L. Journal of Environmental Science and Health, A23(6):513-524.

Mangit, F. and Yerli, S. V. 2018. Systematic evaluation of the genus *Alburnus* (Cyprinidae) with description of a new species. Hydrobiologia, 807(1):297-312.

Mann, R. H. K. 1996. Environmental requirements of European non-salmonid fish in rivers. Hydrobiologia, 323(3):223-235.

Manouchehri, G. R. and Mahmoodian, S. A. 2002. Environmental impacts of dams constructed in Iran. Water Resources Development, 18(1):179-182.

Manouchehri, H., Emadi, H. and Salehi, H. 2005. Constructing a fish egg counter device. Iranian Scientific Fisheries Journal, 14(2):127-144. In Farsi.

Manshouri, M., Pourmand, O., Ahmadisharaf, E. and Alamdari, N. 2011. Qualitative study of Zohreh River water using QUAL2K Model. International Conference on Environmental Pollution and Remediation, 17-19 August 2011, Ottawa, 8 pp.

Mansoori, J. 1994. The Hamoun Wildlife Refuge. Max Kasparek Verlag, Heidelberg. 53 pp., 2 plates.

Mansouri, B. 2016. The study of pollution in the Gorgan bay. Iranian Fisheries Science Research Institute, Tehran. 50 pp. In Farsi.

Mansouri, B. and Baramaki, R. 2011. Influence of water hardness and pH on acute toxicity of Hg on fresh water fish *Capoeta fusca*. World Journal of Fish and Marine Sciences, 3(2):132-136.

Mansouri, B., Baramaki, R. and Ebrahimpour, M. 2012. Acute toxicity bioassay of mercury and silver on *Capoeta fusca* (black fish). Toxicology and Industrial Health, 28(5):393-398.

Mansouri, B., Baramaki, R., Zare, M., Pourkhabbaz, A. and Hamidian, A. H. 2013. Bioaccumulation and depuration of copper in the kidney and liver of a freshwater fish, *Capoeta fusca*. Iranian Journal of Toxicology, 7(20):816-822.

Mansouri, B., Ebrahimpour, M. and Babaei, H. 2011. Determine of heavy metals in different tissues of black fish (*Capoeta fusca*) in central part qanats of Birjand. Veterinary Journal (Pajouhesh va Sazandegi), 24(4)(89):45-52. In Farsi.

Mansouri, B., Ebrahimpour, M., Pourkhabbaz, A., Babaei, H. and Farhangfar, H. 2012. Bioaccumulation and elimination rate of cobalt by *Capoeta fusca* under controlled conditions. Journal of Animal and Plant Sciences, 22(3):622-626.

Mansouri, B., Majnoni, F., Maleki, A., Rezaei, Z., Azadi, N. and Gharibi, F. 2014. Bioaccumulation of Pb, Cd, Zn, and Cu in the muscle, gill, liver, and skin of common carp (*C. carpio*) and silver carp (*H. molitrix*) in Gheshlagh Dam in Sanandaj City. Zanco Journal of Medical Sciences, 15(45):26-35. In Farsi.

Mansouri, B., Maleki, A., Davari, B., Johari, S. A., Shahmoradi, B., Mohammadi, E. and Shahsavari, S. 2016. Histopathological effects following short-term coexposure of *Cyprinus carpio* to nanoparticles of TiO_2 and CuO. Environmental Monitoring and Assessment, 188(10):575.

Mansouri, B., Maleki, A., Davari, B., Karimi, J. and Momeneh, V. 2015. Estimate of target hazard quotients for heavy metals intake through the consumption of fish from Sirvan River in Kermanshah Province, Iran. Journal of Advances in Environmental Health Research, 3(4):235-241.

Mansouri, B., Maleki, A., Davari, B., Karimi, J. and Momeneh, V. 2016a. Bioaccumulation of cadmium, lead, chromium, copper, and zinc in freshwater fish species in Gharasou River in Kermanshah Province, Iran, 2014. Journal of Mazandaran University of Medical Sciences, 26(137):150-158. In Farsi.

Mansouri, B., Maleki, A., Davari, B., Karimi, J. and Momeneh, V. 2016b. Estimation of daily intake and potential risk of heavy metals in different tissues of fish in Gamasyab River. Scientific Journal of Kurdistan University of Medical Sciences, 22(2):112-121. In Farsi.

Mansouri, B., Pourkhabbaz, A., Babaei, H. and Farhangfar, H. 2011. Experimental studies on concentration and depuration of cobalt in the selected organs of fresh water fish *Capoeta fusca*. World Journal of Fish and Marine Sciences, 3(5):387-392.

Mansouri, B., Pourkhabbaz, A., Ebrahimpour, M., Babaei, H. and Hamidian, A. H. 2013. Bioaccumulation and elimination rate of cobalt in *Capoeta fusca* under controlled conditions. Chemical Speciation and Bioavailability, 25(1):52-56.

Mansouri, B., Poursoufi, T. and Gharanjik, B. M. 2021. Changes in physicochemical factors of water in Golestan dam. New Technologies in Aquaculture Development (Journal of Fisheries), 14(4):29-38. In Farsi.

Mansouri, N., Khorasani, N., Karbassi, A. R., Riazi, B. and Panahandeh, M. 2013. Assessing human risk of contaminants in Anzali Wetland fishes. International Journal of

Application or Innovation in Engineering and Management, 2(11):119-126.
Mansouri, N., Khorasani, N., Monavari, S. M., Karbasi, A. and Panahandeh, M. 2013. Non-carcinogenic risk estimation of Cr, Cd, Pb in human to fish consumption from Anzali Wetland. World Journal of Fish and Marine Sciences, 5(6):603-610.
Mansouri Chorehi, B., Ghaffari Farsani, H., Hossaini, S. A., Niazie, E. H. N., Vajargah, M. F. and Hedayati, A. 2013. Acute toxicity of diazinon to the Caspian vimba, *Vimba vimba persa* (Cypriniformes: Cyprinidae). International Journal of Aquatic Biology, 1(6):254-257.
Mansouri-Chorehi, M., Mousavi-Sabet, H., Sattari, M., Nasrollazadeh, A. and Hedayati, A. 2015. Length-length and length-weight relationships of spirlin (*Alburnoides eichwaldii*) in Sefidroud River (the southern Caspian Sea basin). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 59.
Mansouri-Chorehi, M., Mousavi-Sabet, H., Sattari, M., Nasrollazadeh, A. and Hedayati, A. 2016. Age, sex ratio, spawning season and fecundity of *Alburnoides samiii* (Pisces: Cyprinidae), from Sefidroud River (the southwestern Caspian Sea basin). Biharean Biologist, 10(2):93-97.
Mansouri-Chorhi, M., Heidari, A., Mousavi-Sabet, H. and Rostamian, N. 2017. Length-weight Relationship of *Alburnoides samiii* in Sefidroud river, south of the Caspian Sea. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Mansouri Khaje Langi, A., Hashemzadeh Segherloo, I., Narjes Tabatabaei, S. and Abdoli, A. 2014. Analysis of length-weight relationships and condition factor in *Garra rufa* from Palangan and Sirvan Rivers. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Mansouri Khajeh Langi, A., Hashemzadeh Segherloo, I., Narjes Tabatabaei, S. and Abdoli, A. 2017. Geometric analysis of the scale shape to discriminate different populations of *Garra rufa* Heckel, 1843. Nova Biologica Reperta, 3(4):319-326. In Farsi.
Mansournejad, M., Kalantari, B. and Mahdavi Adeli, M. 2015. The investigation of negative effects of salt dome on the quality of water in Gotvand Olya Dam and the use of cut-off wall as treatment. American Journal of Civil Engineering, 3(2-2):53-56.
Maramaei, K., Bahalkeh, A., Azizi, S., Sedaghat, S. and Vejan, A. 2017. Investigating some growth characteristics of *Cyprinion macrostomum* Heckel, 1843 in Dalaki, River - Booshehr Province. Journal of Applied Ichthyological Research, 5(1):31-42. In Farsi.
Marammazi, Gh. 1995. Ichthyology report on Shadegan Marsh. Southern Iran Aquaculture Fishery Research Centre, Ahvaz. 63 pp. In Farsi.
Marammazi, Gh. 1997. Fish stock assessment in Shadegan Wetland, south of Iran. Aquaculture Fishery Research Centre, Ahwaz. 60 pp.
Marammazi, J., Parsamanesh, A., Dehgan, S., Najafpour, N. and Maraashi, S. Z. 1993. Limnological study of Zohreh River. Iranian Fisheries Research Organization, Tehran, pp. 72-95. In Farsi.
Marammazi, J. G. and Kahkesh, F. 2011. Effects of dietary protein and energy levels on growth performance, feed utilization and body composition of juvenile shirbot *Barbus grypus* (Heckle (*sic*), 1843). Iranian Journal of Fisheries Sciences, 10(3):461-474.
Marammazi, J. Gh. 1994. Preliminary ecological investigation of six fish species in Zohre River. Iranian Scientific Fisheries Journal, 3(2):57-70, 6. In Farsi.
Marammazi, J. Gh., Mustafa, A. and Al-Mukhtar, M. A. 2001. The occurrence, feeding and

reproduction of three *Barbus* spp. in Shadegan Marsh. The First National Symposium on Barbus fishes of Iran, 9-10 January 2001, Khuzestan Fisheries Research Centre, Ahvaz. 50 pp. In Farsi.

Marammazi, M., Zakeri, M., Ronagh, M. T., Kochanian, P. and Haghi, M. 2014. Diet and feeding indices of small scale sardeh fish (*Capoeta damascina*) in Sezar River (Lorestan province). Journal of Animal Researches (Iranian Journal of Biology), 27(3):405-416. In Farsi.

Marammazi, M., Zakeri, M., Taghi Ronagh, M., Kochanian, P. and Haghi, M. 2014. Diet and feeding indices of big mouth botak fish (*Cyprinion macrostomum* Heckel, 1843) in the Sezar River (Lorestan province). Journal of Fisheries, 67(3):413-424, 8. In Farsi.

Marammazi, M., Zakeri, M., Taghi Rounagh, M., Kochanian, P. and Haghi, M. 2014. Fish species composition catched by using nets in Sezar River (Lorestan Province). Journal of Animal Environment, 6(3):101-111. In Farsi.

Marandi, A., Harsij, M., Adineh, H. and Jafaryan, H. 2018. Interaction of fish density and background color effects on growth performance, proximate body composition and skin color of common carp, *Cyprinus carpio*. International Journal of Aquatic Biology, 6(3):138-146.

Mar'ashi, A. 1984. Vaza-nama-ye guyesh-e gilaki.... Rasht.

Mardaneh Khatooni, M., Mojazi Amiri, B., Ghelichpour, M., Moosavi, H. and Barari, A. 2012. Developmental stages of eggs and embryo of Caspian kutum (*Rutilus frissi* (*sic*) *kutum* Kamensky, 1901). 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Mardaneh Khatooni, M., Mojazi Amiri, B., Ghelichpour, M. and Moosavi, S. H. 2012. Histological and morphological study of Caspian kutum eggs and embryo development stages (*Rutilus frisii kutum* Kamensky, 1901). Journal of Fisheries (Iranian Journal of Natural Resources), 65(1):67-78. In Farsi.

Marjanizadeh, S., Qureshi, A. S., Turral, H. and Talebzadeh, P. 2009. From Mesopotamia to the Third Millennium: The historical trajectory of water development and use in the Karkheh River basin, Iran. International Water Management Institute, Columbo, Sri Lanka (IWMI Working Paper, 135:vii + 43 pp.).

Markham, A. (Ed.). 1989. Painful death of the Caspian Sea. World Wildlife Fund Special Report, 1:1 p.

Markun, M. I. 1929. Materialy po sistematike shamai (*Alburnus chalcoides*) [Material on the systematics of shemaya (*Alburnus chalcoides*)]. Izvestiya Otdela Prikladnoi Ikhtiologii i Nauchno-promyslovykh Issledovanii, 9(2):179-190.

Marwick, R. and Germond, J. P. 1975a. The River Lar multipurpose project in Iran. Part One. Water Power & Dam Construction, 27(4):133-141.

Marwick, R. and Germond, J. P. 1975b. The River Lar multipurpose project in Iran. Part Two. Water Power & Dam Construction, 27(5):178-183.

Marzban, A., Elhami, B. and Bougari, E. 2021. Integration of life cycle assessment (LCA) and modeling methods in investigating the yield and environmental emissions final score (EEFS) of carp fish (*Cyprinus carpio*) farms. Environmental Science and Pollution Research, 28(15):19234-19246.

Mashai, M. A. and Peyghan, R. 1998. Health and culture of warmwater fishes. Noorbaksh, Tehran. 118 pp.

Mashinchian Moradi, A., Alidoust Salimi, M., Shahhosseini, M. H. and Alidoust Salimi, P. 2012.

Assessment of DNA damage induced by butachlor on *Cyprinus carpio* (L. 1758) using single cell gel electrophoresis. International Journal of Marine Science and Engineering, 2(4):233-238.

Mashinchian Moradi, A., Mozdarani, H., Alidoust Salimi, P. and Alidoust Salimi, M. 2012. Evaluation of DNA damage in *Cyprinus carpio* (L. 1758) exposed to malathion using single cell gel electrophoresis. International Journal of Marine Science and Engineering, 2(3):185-188.

Masompour, Y., Gorgin, S., Pighambari, S. Y., Karimzadeh, Gh., Babanejad, M. and Eighani, M. 2018. The impact of ghost fishing on catch rate and composition in the southern Caspian Sea. Marine Pollution Bulletin, 135:534-539.

Mason, K., Sherwin-White, A. N. and Hyamson, A. M. 1944. Iraq and the Persian Gulf. Naval Intelligence Division, Geographical Handbook Series, B.R. 524, London. xviii + 681 pp, map.

Masoomi, H. and Vazirzadeh, A. 2019. Singular versus combined effect of some probiotics on the mucosal immunity of common carp (*Cyprinus carpio*). Journal of Animal Researches (Iranian Journal of Biology), 32(3):286-298. In Farsi.

Masoudi, M., Zehtabiyan, G. R., Noruzi, R., Mahdavi, M. and Kuhenjani, S. B. 2009. Hazard assessment of ground water resource degradation using GIS in Mond Miyani basin, Iran. World Applied Sciences Journal, 6(6):802-807.

Masoumi, S., Jamili, S., Niknejad, H. and Mashinchian, A. 2015. Toxic effects of nanosilver on red blood cells (RBC) and liver tissue of common carp (*Cyprinus carpio*). Journal of Animal Environment, 6(4):177-185. In Farsi.

Masoumian, M. 1997a. Myxosporean parasites of freshwater fishes from south-western part of Iran. In: 8th International Conference of the European Association of Fish Pathologists: Diseases of Fish and Shellfish, Edinburgh, 14-19 September 1997 (abstract).

Masoumian, M. 1997b. Myxosporean parasites of freshwater fishes from south-western part of Iran. In: 8th International Conference of the European Association of Fish Pathologists: Diseases of Fish and Shellfish, Edinburgh, 14-19 September 1997 (abstract).

Masoumian, M. 2007. Survey on parasitic infections in the endemic fishes from north of the West-Azarbayzan (Aras, Zangbar and Ghotor Rivers). Iranian Fisheries Science Research Institute, Tehran. 74 pp. In Farsi

Masoumian, M., Barzegar, M., Mehdipoor, M., Asadollah, S. and Jalali, B. 2007. *Myxobolus* spp. (Myxosporea: Myxobolidea) from fishes of the Zayandeh-rud River (Esfahan, Iran); new hosts and locality record. Iranian Journal of Fisheries Sciences, 7(1):89-100.

Masoumian, M., Baska, F. and Molnár, K. 1994. Description of *Myxobolus karuni* sp. n. and *Myxobolus persicus* sp. n. (Myxosporea, Myxozoa) from *Barbus grypus* of the River Karun, Iran. Parasitologia hungarica, 27:21-26.

Masoumian, M., Baska, F. and Molnár, K. 1996a. Description of *Myxobolus bulbocordis* sp. nov. (Myxosporea: Myxobolidae) from the heart of *Barbus sharpeyi* (Günther) and histopathological changes produced by the parasite. Journal of Fish Diseases, 19(1):15-21.

Masoumian, M., Baska, F. and Molnár, K. 1996b. *Myxobolus nodulointestinalis* sp. n. (Myxosporea, Myxobolidae), a parasite of the intestine of *Barbus sharpeyi*. Diseases of Aquatic Organisms, 24(1):35-39.

Masoumian, M., Choubchian, M., Pazouki, J., Sharifpour, I. and Jalali, B. 2008. Histozoic developmental stages of *Myxobolus karuni* and *Myxobolus persicus* and introducing three

new hosts. Journal of Veterinary Research, 63(3):117-122. In Farsi.
Masoumian, M. and Hosaini, S. H. 2015. Collection, identification of Iranian fish parasites for "Iranian parasitology Museum". Tehran, Iran, Iranian Fisheries Science Research Institute, Jihad-e Agriculture, Tehran, 68 pp. In Farsi.
Masoumian, M., Mehdizadeh, A. and Yahyazadeh, M. 2002. Protozoans (Coccidia and Myxosporea) infections in some fishes of Aras and Mahabad Dams (northwest of Iran). Iranian Scientific Fisheries Journal, 11(2):79-90. In Farsi.
Masoumian, M. and Pazooki, J. 1998. Survey on myxosporean parasites in the Mazandaran and Guilan provinces (southern part of Caspian Sea). Iranian Scientific Fisheries Journal, 7(3):57-74, 6. In Farsi.
Masoumian, M. and Pazooki, J. 1999a. Myxosporean parasites from freshwater fishes of Guilan and Mazandaran provinces. Iranian Journal of Fisheries Sciences, 7(3):47-57. In Farsi. (*sic*, original not located)
Masoumian, M. and Pazooki, J. 1999b. Myxosporean parasites from Mesopotamian part of Iran. Iranian Journal of Fisheries Sciences, 1(1):35-46.
Masoumian, M., Pazooki, J. and Ghasemi, R. 2003. *Myxobolus* infection in three *Barbus* spp. from the southern part of the Caspian Sea. Journal of the Faculty of Veterinary Medicine, University of Tehran, 58(4):329-334. In Farsi.
Masoumian, M., Pazooki, J., Yahyazadeh, M. and Teymornezhad, A. 2005. Protozoan (*sic*) from fresh water fishes of north west Iran. Iranian Journal of Fisheries Sciences, 4(2):31-42, 115.
Masoumian, M., Setareh, J. and Mokhayer, B. 2002. Parasitological investigations on *Rutilus rutilus caspicus* from south-east of the Caspian Sea (Iran). Iranian Scientific Fisheries Journal, 10(4):61-74. In Farsi.
Masrour, M., Rezvani, M., Khara, H. and Jamalzad, F. 2013. The effectiveness of education extension course on environmental awareness of aquaculture in Guilan Province, Iran. Journal of Aquaculture Development, 7(1):75-86. In Farsi.
Masson, L., Almeida, D., Tarkan, A. S., Önsoy, B., Miranda, R., Godard, M. J. and Copp, G. H. 2011. Diagnostic features and biometry of head bones for identifying *Carassius* species in faecal and archaeological remains. Journal of Applied Ichthyology, 27(5):1286-1290.
Massoud, J., Jalali, H. and Reza, M. 1981. Studies on trematodes of the family Heterophyidae (Odhner, 1914) in Iran: 1. Preliminary epidemiological surveys in man and carnivores in Khuzestan. Journal of Helminthology, 55(4):255-260.
Mathias, P. 1921. Étude du genre *Chondrostoma* dans l'Europe occidentale et la région circumméditerranéanne. Mémoires de la Société zoologique de France, 28(1/2):1-52, pl. I-II.
Matinfar, A. 2001. Diversification of aquaculture in Iran. In: Kjørsvik, E. and Stead, S. (Eds.). Aquaculture Europe 2001. Abstracts of contributions presented at the International Conference Aquaculture Europe 2001, Trondheim, Norway, 4-7 August 2001. EAS Special Publication, 29:xiv + 286 pp.
Matinfar, A. 2003. Endangered fish and shellfish species of Iran. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).
Matinfar, A. 2016. Species diversity in Iran aquaculture. Iranian Fisheries Science Research Institute, Tehran. 64 pp. In Farsi.
Matinfar, A., Mosavi Nodoshan, R., Abasi, E., Zaree, E., Alasvandi Toghyan, F. and Salehi, M. 2010. Food regime of wild common carp (*Cyprinus carpio*) in Golestan Province,

Gomishan coastal area (Caspian Sea). Journal of Marine Science and Technology Research, 5(2):33-42. In Farsi.

Matinfar, A. and Nikouyan, A. 1995. Islamic Republic of Iran, pp. 207-226. In: Report on a regional study and workshop on the environmental assessment and management of aquaculture development. Network of Aquaculture Centres in Asia-Pacific, Bangkok. 491 pp.

Mattagi, A-A., Hedayati-Fard, M. and Safarpour Amlashi, A. 2017. Fish fauna of Kheiroud River in Mazandaran Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Matveyev, M. P., Levina, M. A., Mamilov, N. Sh. and Levin, B. A. 2017. Tashkent riffle minnow *Alburnoides oblongus* belongs to the genus *Alburnus* (Osteichthyes: Cyprinidae) as inferred from mitochondrial and nuclear DNA markers. Inland Water Biology, 10(4):360-367.

Maulood, B. K., Hinton, G. C. F., Kamees, H. S., Saleh, F. A. K., Shaban, A. A. and Al Shahwani, S. M. H. 1979. An ecological survey of some aquatic ecosystems in southern Iraq. Tropical Ecology, 20(1):27-40.

Maulood, B. K., Hinton, G. C. F., Whitton, B. A. and Al-Saadi, H. A. 1981. On the algal ecology of the lowland Iraqi marshes. Hydrobiologia, 80(3):269-276,

Mayden, R. L. and Chen, W-J. 2010. The world's smallest vertebrate species of the genus *Paedocypris*: A new family of freshwater fishes and the sister group to the world's most diverse clade of freshwater fishes (Teleostei: Cypriniformes). Molecular Phylogenetics and Evolution, 57(1):152-175.

Mayden, R. L., Chen, W-J., Bart, H. L., Doosey, M. H., Simons, A. M., Tang, K. L., Wood, R. M., Agnew, M. K., Yang, L., Hirt, M. V., Clements, M. D., Saitoh, K., Sado, T., Miya, M. and Nishida, M. 2009. Reconstructing the phylogenetic relationships of the earth's most diverse clade of freshwater fishes - order Cypriniformes (Actinopterygii: Ostariophysi): A case study using multiple nuclear loci and the mitochondrial genome. Molecular Phylogenetics and Evolution, 51(3):500-514.

Mazaheri, Z. 2007. Age and growth of *Capoeta damascina* in Zayende-Roud River Isfahan Province, central Iran. B.Sc. Project, Isfahan University of Technology, Isfahan, Iran. 85 pp.

Mazaheri Kohanestani, Z., Ghorbani, R., Hajimoradloo, A., Naeimi, A. and Fazel, A. 2013. The effects of trout farm effluents on water quality parameters of Zaringol Stream (Golestan, Iran) using NSFWQI and WQI indexes (*sic*). International Journal of Environmental Resources Research, 1(2):191-202.

Mazaheri Kohanestani, Z., Ghorbani, R., Hajimoradloo, A., Yulghi, S. and Hoseini, A. 2014. Effect of parasite infection with *Posthodiplostomum cuticola* (Nordmann, 1832) on fish growth rate in Zaringol Stream in Golestan Province. Iranian Scientific Fisheries Journal, 22(4):128-134. In Farsi.

Mazaheri Kohanestani, Z., Hajimoradloo, A. and Ghorbani, R. 2017. Study on hematological parameters of infected *Capoeta capoeta gracilis* with *Posthodiplostomum cuticola* in Zaringol Stream-Golestan Province. Journal of Experimental Animal Biology, 6(1):59-70. In Farsi.

Mazaheri Kohanestani, Z., Hajimoradloo, A., Ghorbani, R., Yulghi, S., Hoseini, A. and Molaee, M. 2013. Seasonal variations in hematological parameters of *Alburnoides eichwaldii* in Zaringol Stream - Golestan Province, Iran. World Journal of Fish and Marine Sciences,

(2):121-126.
Mazaheri Kohestani, Z., Hajimoradloo, A., Ghorbani, R., Hosseini, S. A. and Yelghi, S. 2014. Relationships of the host and pathogen: emphasizing the *Posthodiplostomum cuticola* (Nordmann, 1832) of fish species in the Zaringol Stream Golestan Province. Journal of Applied Ichthyological Research, 1(4):65-80. In Farsi.
Mazaheri Kouhanestani, Z., Ghorbani, R., Fujiwara, M., Rabaniha, M., Amini, K. and Mahmoodi, S. 2020. Identification of larval stages of fish in southeastern coastal waters of the Caspian Sea - Golestan Province. Iranian Journal of Fisheries Sciences, 19(1):325-339.
Mazahery Tehrani, Z. and Keramat Amiri, A. S. 2017. Physical characteristics extruded and pressed pellets for feed salmon (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*). Journal of Animal Environment, 8(4):171-178. In Farsi.
Mazandarani, A., Khodadadi Arpanahi, F., Jafari, L. and Amini, K. 2019. Survey on susceptibility of common carp, *Cyprinus carpio*, to exposure with *Yersinia ruckeri*. Journal of Applied Ichthyological Research, 6(3):75-84. In Farsi.
Mazandarani, H. and Darvishi, G. R. 2018. Short time exposure to lethal concentrations of unionized ammonia in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 6(4):13-19. In Farsi.
Mazandarani, M., Dehghani Ghomshhani, M., Soudagar, M. and Hosseini, S. M. 2019. Improvement of common carp (*Cyprinus carpio*) fingerlings resistance to salinity stress with dietary safflower (*Carthamus tinctorius* L) extract supplementation. Journal of Aquaculture Development, 13(2):97-106. In Farsi.
Mazandarani, M., Hajimoradloo, A. and Hoseini, A. 2019. Survey on helminthic infections in abdominal cavity of common bream (*Abramis brama orientalis*) in Alagol dam (Golestan, Iran). Journal of Aquaculture Development, 12(4):121-130. In Farsi.
Mazandarani, M., Hoseini, A. and Hajimoradloo, A. 2018. Survey on parasite infestation of two years old carp bream *Abramis brama*, to *Ligula intestinalis* in Alagol lake and Gorganroud, Golestan Province. Journal of Marine Sciences and Technology,17(3):23-33. In Farsi.
Mazandarani, M., Sodagar, M. and Zakariaii, H. 2015. Long time exposure effects of sub-lethal unionized ammonia concentrations on growth and hematologic indices of Caspian roach *Rutilus caspicus* (Yakovlev, 1879) fingerlings. Journal of Applied Ichthyological Research, 3(1):53-64. In Farsi.
Mazandarani, M., Sudagar, M. and Namroodi, S. 2015. Histopathological effects of acute copper sulphate exposure on kidney, liver and gill of common carp, *Cyprinus carpio*, fingerlings. Journal of Aquatic Ecology, Hormozgan University, 5(1):9-16. In Farsi.
Mazandarani, M., Sudagar, S. and Kolangi Miandare, H. 2016. Short time exposure to lethal unionized ammonia concentrations (high levels) in Caspian roach, *Rutilus caspicus*. Journal of Aquaculture Development, 10(2):119-126. In Farsi.
Mazlomi, M. 2003. Streptococcosis Antrococcosis. Important Economic Disease in Fish Culture. Navid Shiraz Publication, Iran. 94 pp. In Farsi.
Mazurmovich, B. N. 1983. Alexandr Mikhailovich Nikolsky. Nauka, Moscow. 81 pp. In Russian.
McClelland, J. 1842. On the fresh-water fishes collected by William Griffith in his travels from 1835-1842. Journal of Natural History, Calcutta, 2(8):560-589.
McClure, H. A. 1976. Radiocarbon chronology of late Quaternary lakes in the Arabian Desert.

Nature, London, 263(5572):755-756.
McLachlan, K. 1988. The Neglected Garden: The Politics and Ecology of Agriculture in Iran. I. B. Tauris & Co. Ltd., London. xxi + 303 pp.
McLachlan, K. and Schofield, R. N. 1987. A Bibliography of the Iran-Iraq Borderland. Middle East & North African Studies Press Limited, Wisbech. xii + 383 pp.
Mearns, B. and Mearns, R. 1988. Biographies for Birdwatchers. The Lives of Those Commemorated in Western Palearctic Bird Names. Academic Press, New York. xx + 490 pp.
Megerdoomian, K. 2008. The Structure of Persian Names. Mitre Technical Report, MP080034, Mitre Corporation. 10 pp. (www.zoorna.org/papers/PersianNames-MP088034-Released_08-1036.pdf).
Mehdi Haghparast, M., Alishahi, M., Ghorbanpour, M. and Shahriari, A. 2017. Effect of use biofloc technology on biochemical azalysing (*sic*) of carp fish and biofloc in intensive system. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 315-319. In Farsi.
Mehdi Haghparast Radmard, M., Alishahi, M., Ghorbanpour, M. and Shahriari, A. 2018. Evaluation of different C/N ratios effect at intensive biofloc system on growth performance and health of common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(2):169-170. In Farsi.
Mehdi Mirdamadi, S., Lashgarara, F. and Heydari, M. 2011. Influencing factors in increasing Lorestan province’s fish ponds production, Iran. Research Journal of Fisheries and Hydrobiology, 6(3):117-120.
Mehdinasab, M. 2019. Evaluation trophy based on Carlsson Index (TSI) case study: Permanent wetlands in Pol-e-dohktar County. Iranian Scientific Fisheries Journal, 28(2):179-185. In Farsi.
Mehdinejad, N., Taghizadeh, V. and Imanpour, M. R. 2013. Correlation between serum steroid hormones and some biological parameters of gonad of common carp (*Cyprinus carpio*) in Caspian Sea, Iran. Global Veterinaria, 10(1):55-59.
Mehdipoor, M., Barzegar, M. and Jalali, B. 2004. A survey on monogenean parasites of gills of fishes in Zayandeh-rud River. Iranian Journal of Veterinary Sciences, 2:19-28. In Farsi.
Mehdipour, M. 2006. Parasites of native and introduced fishes of Zayandehrud River. Ph. D. Thesis, Islamic Azad University, Science and Research Branch, Tehran. 167 pp.
Mehdipour, M., Barzegar, M. and Jalali, B. 2002. Evaluation of monogenean parasites of the fish gill in Zayandeh River. Iranian Journal of Veterinary Sciences, 1(2):56-63. In Farsi.
Mehdipour, S. Z., Shokrzadeh, M., Khanzadi, S. and Shasavani, D. 2018. Effects of cooking methods on the concentrations of lead, chromium and cadmium in whitefish (*Rutilus frissi* (*sic*) *kutum*) from the Caspian Sea, Iran. Iranian Journal of Chemistry and Chemical Engineering, 37(1):141-147.
Mehdizadeh Mood, S. 2009. Study of ectoparasite infestation of 10 common imported freshwater ornamental fish species. Ph.D. Thesis, University of Tehran. 104 pp. In Farsi.
Mehraban, H. R., Sayyadzadeh, G., Malekzehi, H. and Ahmadi, A. 2014. First report of infection with the tapeworm *Ligula intestinalis* (Linnaeus, 1758) plerocercoids in Persian bleak, *Alburnus hohenackeri* Kessler, 1870 in southeastern Iran. Iranian Journal of Ichthyology, 1(1):12-16.
Mehraban, N. 1996. Income effect on fish demand in Iran (1971-1994). Shilat (Fisheries), Tehran. 42 pp. In Farsi.

Mehrabani, Z., Bahrami Kamangar, B. and Ghaderi, E. 2021. Evaluation of genetic variability of longspine scraper *Capoeta trutta* (Heckel, 1843) populations from Kurdistan province using IRAP markers. Iranian Scientific Fisheries Journal, 29(6):65-76. In Farsi.

Mehrabi, F., Khalesi, M. K. and Farhadi, A. 2015. Polymorphism of insulin-like growth factor binding factor protein-3 (*IGFBP-3*) gene associated with growth traits in *Cyprinus carpio*. Iranian Journal of Ichthyology, 2(3):172-176.

Mehrabi, F., Khalesi, M. K. and Hazaie, K. 2017. Effects of pre- and probiotics on growth, survival, body composition, and hematology of common carp (*Cyprinus carpio* L.) fry from the Caspian Sea. Turkish Journal of Fisheries and Aquatic Sciences, 18(4):597-602 (dated 2018).

Mehrabi, H. 2004. Gav-Khooni Pond. Jam-e-Jam, Tehran, 1181:17 (6 July 2004).

Mehrabian Fard, M., Baghshani, H., Shahsavani, D. and Gholipour, H. 2017. Effect of dietary supplementation of spirulina (*Spirula platensis*) on cyanide-induced oxidative damage of common carp *Cyprinus carpio* Linnaeus, 1758. Journal of Applied Ichthyological Research, 5(3):103-114. In Farsi.

Mehrad, B., Imanpoor, M. R., Kashani, Z. H. and Mofidi, M. B. 2010. The correlation between water physicochemical and ionic parameters with growth indicators in *Rutilus frisii kutum*. AACL Bioflux, 3(3):211-217.

Mehravar, S. 2010. Study on the population dynamics of *Alburnoides bipunctatus* in Zaringol Stream, Golestan Province, Iran. M.Sc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources. 100 pp.

Mehregan Nikoo, A. R., Sadghi Mahoonak, A. R., Ghorbani, M., Taheri, A. and Alami, M. 2013. Optimization of different factors affecting antioxidant activity of crucian carp (*Carassius carassius*) protein hydrolysate by response surface methodology. Electronic Journal of Food Processing and Preservation, 5(1):95-110.

Mehrjo, F., Abdoli, A., Hashemi, S. H. and Hosseinabadi, F. 2020. Development of a multimetric index based on benthic macroinvertebrates for downstream Jajrud River in Tehran province, Iran. Iranian Journal of Fisheries Sciences, 19(1):286-296.

Mehrtabor, R. R. 1960. Fishes of Iran. Tehran. 123 pp. In Farsi.

Meigolinezhad, A. 2000. The effective parameters of fish consumption in land-locked cities and the method of increasing fishes by using Delphi Method. M.Sc. Thesis, Amirkabir University of Technology, Tehran. 88 pp. In Farsi.

Meijer, K. 2006. Integrated water resources management for the Sistan closed inland delta, Iran. Annex E. Socio-economic valuation of allocating water to the hamouns and to agriculture. WL Delft Hydraulics, The Netherlands. v + 89 pp.

Meknatkhah, B., Haghparast, P., Rahmati, M., Bagheri, M, and Falahatkar, B. 2016. Morphometric and meristic characteristics of female asp x male kutum (*Leuciscus aspius* ♀ x *Rutilus frisii* ♂). Journal of Aquaculture Sciences, 4(1):1-11. In Farsi.

Mellat-Parast, A. 1992. Temperature and water fluctuations in the southern Caspian Sea. Iranian Fisheries Bulletin, 1:28-41, 7. In Farsi.

Melville, C. 1984. Meteorological hazards and disasters in Iran: a preliminary survey. Iran (Journal of the British Institute of Persian Studies), 22:113-150.

Mendel, J., Lusk, S., Vasil'eva, E. D., Vasil'ev, V. P., Lusková, V., Guler Ekmekci, F., Erk'akan, F., Ruchin, A., Koščo, J., Vetešník, L., Halačka, K., Šanda, R., Pashkov, A. N. and Reshetnikov, S. I. 2008. Molecular phylogeny of the genus *Gobio* Cuvier, 1816

(Teleostei: Cyprinidae) and its contribution to taxonomy. Molecular Phylogenetics and Evolution, 47(3):1061-1075.

Ménétries, E. 1832. Catalogue raisonné des objets de zoologie recueillis dans un voyage au Caucase et jusqu'aux frontières actuelles de la Perse. St. Pétersbourg. 300 pp.

Menon, A. G. K. 1954. Fish geography of the Himalayas. Proceedings of the National Institute of Science of India, 20(4):467-493.

Menon, A. G. K. 1957. The external relationships of the Indian freshwater fishes, with special reference to the countries bordering on the Indian Ocean. Journal of the Asiatic Society, Science, 21(1)(1955):31-38.

Menon, M. A. S. 1960. On a third collection of fish from Iraq. Records of the Indian Museum, 54(3-4)(1956):139-157, pl. 2.

Menon, A. G. K. 1964. Monograph of the cyprinid fishes of the genus *Garra* Hamilton. Memoirs of the Indian Museum, 14(4):173-260, pl. VIII-XIII.

Menon, A. G. K. 1999. Check list - fresh water fishes of India. Records of the Zoological Survey of India, Miscellaneous Publication, Occasional Paper, 175:xxviii + 366 pp.

Menon, A. G. K. and Yazdani, G. M. 1968. Catalogue of type-specimens in the Zoological Survey of India. Part 2.-Fishes. Records of the Zoological Survey of India, 61(1 & 2):1-190.

Merchant, N. M. and Ronaghy, H. A. 1976. Water resources and pollution control planning in Iran. Journal of Environmental Health, 38(6):406-409.

Meriç, N., Eryılmaz, L. and Özuluğ, M. 2007. A catalogue of the fishes held in the Istanbul University, Science Faculty, Hydrobiology Museum. Zootaxa, 1472(1):29-54.

Merritt-Hawkes, O. A. 1935. Persia: Romance and Reality. Ivor Nicholson and Watson, London. xv + 324 pp.

Merufinia, E., Aram, A. and Esmaeili, F. 2014. Saving the Lake Urmia: from slogan to reality (challenges and solution). Bulletin of Environmental Pharmacology and Life Sciences, 3(Special Issue III):277-288.

Mesbah, M., Mohammadian, T., Karami, E., Molayem Raftar, T. and Nazari, M. 2015. Effects of salinity stress on some hematological parameters and cortisol hormone in *Mesopotamichthys sharpeyi*. Journal of Aquatic Ecology, Hormozgan University, 5(2):68-78. In Farsi.

Mesbah, M., Razijalali, M., Alishahi, M. and Akbarzadeh, A. 2010. Zoonotic parasitic contamination study of *Barbus grypus* fish in Karkheh River. Scientific Research Iranian Veterinary Journal, 6(3)(28):20-27.

Mesbah, M., Rezaie, A. and Dezfuly, Z. T. 2016. Case report of chondroma in a grass carp (*Ctenopharyngodon idella*). Veterinary Research Forum, 7(2):173-176.

Mesgaran, N. and Roomiani, L. 2018. Effect of nisin, sodium lactate and MAP packaging on the shelf life of silver carp (*Hypophthalmichthys molitrix*) burger. Iranian Scientific Fisheries Journal, 27(2):91-103. In Farsi.

Meshgi, B., Eslami, A. and Yazdani, H. 2006. Study on parasitic infections of aquarium fishes around Tehran. Journal of the Veterinary Faculty of the University of Tehran, 61(1):1-5.

Meshkini, S. and Rasooli Aghdam, H. 2019. Comparing accumulation of some heavy metals (mercury, copper, zinc) in liver and muscle tissues of grown carp and sea carp. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 32(2):75-83. In Farsi.

Mhaisen, F. T. 1980. Fish Parasitology in Iraq. Basrah Natural History Museum Publication, 3:1-

36, IX plates.
Miar, A., Bozorgnia, A., Pazooki, J., Barzegar, M., Masoumian, M. and Jalali, B. 2008. Identification of parasitic fauna of fishes in Valasht Lake and Chalus River. Iranian Scientific Fisheries Journal, 17(1):133-138. In Farsi.
Michel, A. A. 1973. The impact of modern irrigation technology in the Indus and Helmand basins of southwest Asia, pp. 257-275. In: Farvar, M. T. and Milton, J. P. (Eds.). The Careless Technology. Ecology and International Development. Tom Stacey, London. xxix + 1030 pp.
Micklich, N. and Roscher, B. 1990. Neue Fischfunde aus der Baid-Formation (Oligozän; Tihamat Asir, SW Saudi-Arabien). Neues Jahrbuch für Geologie und Paläontologie Abhandlungen, 180(2):139-175.
Micklin, P. P. 1979. Disciplinary plans for USSR rivers. Geographical Magazine, 51(10):701-706.
Micklin, P. P. 1986. Soviet river diversion plans: their possible environmental impact, pp. 91-106. In: Goldsmith, E. and Hildyard, N. (Eds.). The Social and Environmental Effects of Large Dams. Volume Two: Case Studies. Wadebridge Ecological Centre, Camelford, U.K. 331 pp.
Mietle, P. L. 1967. The fisheries of the Near East region. Fisheries Circular, Food and Agriculture Organization, 112:140 pp.
Mikaeili, A. R., Abdoli, A. and Amini Nasab, S. M. 2005. Physical structure of the Madar-sou stream in Golestan National Park. Journal of Agricultural Sciences and Natural Resources, 12(3):100-111. In Farsi.
Mikaili, P. and Shayegh, J. 2011. An etymological review on fish common and scientific names in the Euphrates and Tigris. Research Journal of Fisheries and Hydrobiology, 6(4):412-423.
Mikailov, T. K. 1975. Parazity ryb vodoemov Azerbaidzhana (sistematika, dinamika, proiskhozhdenie) [Fish parasites of the waters of Azerbaidzhan (systematics, dynamics, origin]. Akademiya Nauk Azerbaidzhanskoi SSR, Institut Zoologii, Baku. 299 pp.
Mikailov, T. K. and Ibragimov, Sh. P. 1980. Ekologiya i zoogeografiya parazitov ryb vodoemov Lenkoranskoi pripodnoi oblasti [Ecology and zoogeography of the fish parasites of the natural waters of the Lenkoran region]. Akademiya Nauk Azerbaidzhanskoi SSR, Institut Zoologii, Baku. 115 pp.
Miller, N. F. 1985. Paleoethnobotanical evidence for deforestation in ancient Iran: a case study of urban Malyan. Journal of Ethnobiology, 5(1):1-19.
Mina, M. V. 1992. Problems of protection of fish faunas in the USSR. Netherlands Journal of Zoology, 42(2-3):200-213.
Mina, M. V., Mironovsky, A. N. and Golani, D. 2001. Consequences and modes of morphological diversification of East African and Eurasian barbins (genera *Barbus*, *Varicorhinus* and *Capoeta*) with particular reference to *Barbus intermedius* complex. Environmental Biology of Fishes, 61(3):241-252.
Minabi, E., Yavari, V. and Morammazi, J. 2020. Evaluation of growth and production of common carp *Cyprinus carpio* in aquaponic system and traditional aquaculture method. Journal of Wetland Ecobiology, 11(4):19-24. In Farsi.
Minabi, K., Sourinejad, I., Alizadeh, M., Rajabzadeh Ghatrami, E. and Khanjani, M. H. 2020. Effects of different carbon to nitrogen ratios in the biofloc system on water quality, growth, and body composition of common carp (*Cyprinus carpio* L.) fingerlings.

Aquaculture International, 28(5):1883-1898.

Minabi, K., Zakeri, M., Marammazi, J., Yavari, V. and Mosavi, S. M. 2015. Effects of dietary replacement of fish oil with canola oil in the diet of juvenile common carp, *Cyprinus carpio* on growth performance and feeding utilization of body and diet economic index. Journal of Fisheries, 68(1):157-175. In Farsi.

Minabi, K., Zakeri, M., Ronagh, M. T., Kochanian, P., Haghi, M., Marammazi, M. and Minabi, E. 2012. Investigation of changes biochemical composition of botak fish (*Cyprinion macrostomum*) and tiny scales siahmahi (*Capoeta damascina*) in the warm (summer) and cold season (autumn). Journal of Wetland Ecobiology, 3(11):57-66. In Farsi.

Minabi, Kh., Sourinejad, I., Alizadeh, M. and Rajabzadeh, E. 2020. Effects of using different C/N ratios in biofloc system on growth performance, feeding and water quality indices of common carp (*Cyprinus carpio*) culture. Iranian Scientific Fisheries Journal, 28(6):13-24. In Farsi.

Minorskii, V. F. 1916. The Turko-Persian Demarcation. Proceedings of the Russian Geographical Society, 52:351-393, XXI-XXXI figures and maps. In Russian (https://elib.rgo.ru/handle/123456789/73802).

Mira, S. M., Akrami, R. and Hedayatifard, M. 2011. Effect of different level of dietary prebiotics inulin on the growth performance, survival and body composition of juvenile kutum (*Rutilus frisii kutum*). Journal of Marine Biology, 3(1):53-59. In Farsi.

Mirabzadeh-Ardakani, P. 2014. Political ecology of conservation in the 'Alagol, Ulmagol, and Ajigol' global wetlands, Turkmen Sahra, northeast Iran. Ph.D. Thesis, Carleton University, Ottawa. xvii + 457 pp.

Mir-Ashrafi Langroudi, S. M., Ghaffari, M. and Gharaei, A. 2013. Investigation on some biological characteristics of Kura barbel *Barbus lacerta* Heckel, 1843 in Sefidroud River (Guilan Province). Journal of Applied Ichthyological Research, 1(1):67-86, 6. In Farsi.

Mirashrafi Langroudi, S. M., Ghaffari, M., Andalibi, T., Yavari, A. and Gharaei, A. 2013. Survey of some biological characteristics of (Cyprinidae: *Cyprinion watsoni*), in Karvander River (southeast of Iran). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 86 (abstract).

Mirbagheri, S. A. 1995. Best management practices in erosion control and sediment production from the watershed area of a dam. WRM '95. Proceedings of the Regional Conference on Water Resources Management, Conference Secretariat, Isfahan University of Technology, Isfahan, pp. 467-476.

Mirchi, A., Madani, K., AghaKouchak, A. 2015. Lake Urmia: how Iran's most famous lake is disappearing. www.theguardian.com/world/series/tehran-bureau, accessed 23 January 2015.

Mirdar Harijani, J., Dahmardeh, H., Gharaei, A. and Rahdari, A. 2013. Different methods for the treatment of white spot disease (*Ichthyophthirius multifiliis* (*sic*)) in. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, 7 pp.

Mirdar Harijani, J., Iazadi, G. and Abbaspour, F. 2015. Morphometric and meristic study of *Capoeta barroisi* in Tange-Sorkh River (Fars province). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 214.

Mirdar Harijani, J. and Tofighi Moghadam, S. 2017. The effect of anesthetic lavender (*Lavandula officinalis*) essential oil on histopathological and blood serum enzymes of snow trout (*Schizothorax zarudnyi*). Journal of Animal Researches (Iranian Journal of Biology), 30(2):152-168. In Farsi.

Mirfendereski, G. 2000. Evolution of Iranian sovereignty in the Caspian Sea, pp. 227-262. In: Amirahmadi, H. (Ed.). The Caspian Region at a Crossroad. Challenges of a New Frontier of Energy and Development. St. Martin's Press, New York. xii + 299 pp.

Mirhashemi Nasab, S. F., Daghigh Roohi, J., Faeed, M., Ghasemi, M. and Asgharnia, M. 2020. Survey of parasitic infections in Prussian carp (*Carassius gibelio*) of Ardebil Neor Lake (in 2016). Journal of Animal Environment, 12(2):261-266. In Farsi.

Mirhashemi Nasab, S. F., Omidvar, S., Nosrati, M., Daghigh Roohi, J., Faeed, M., Ghasemi, M. and Ramezani Aghele, B. 2017. Prevalence of Diplostomum parasite in some fish of the Anzali Wetland. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Mirhasheminasab, S. F. and Pazooki, J. 2003. Identification of crustacean parasites in some fishes of Mahabad Reservoir. Iranian Scientific Fisheries Journal, 11(4):133-148. In Farsi.

Miri, M. 2018. Water quality assessment Chahnimeh reservoirs in Sistan basin basis via NSFWQI, IRWQISC and Liou indexes (*sic*). Journal of Wetland Ecobiology, 9(4):87-100. In Farsi.

Mirkou, N. 2001. Environmental audit of agro-chemical usage along the Caspian shore of I. R. Iran. Caspian Environment Programme, Baku, Azerbaijan. 31 pp.

Mirnia, N., Mirdar Harijani, J., Gharaei, A. and Rigi, M. 2019. Survey of some metal elements (Cu, Zn, Ni, Pb) accumulation in muscle, liver, kidney and gill of *Schizocypris altidorsalis* in Chahnimeh reservoirs of Sistan. Iranian Scientific Fisheries Journal, 28(5):157-161. In Farsi.

Mironovskii, A. N. 1991. Variability and population structure of some cyprinid fishes in the Volga-Caspian and adjacent regions. 1. Population subdivision. Journal of Ichthyology, 31(8):96-105.

Mironovskii, A. N. 1992. Variability and population structure of some cyprinid fishes in the Volga-Caspian and adjacent regions. 2. Analysis of character variability. Journal of Ichthyology, 32(1):77-87.

Mironovskii, A. N. and Kas'yanov, A. N. 1986. Struktura vida *Rutilus rutilus* v basseine Kaspiiskogo Morya [The *Rutilus rutilus* species structure in the Caspian Sea basin]. Zoologicheskii Zhurnal, 65(7):1024-1031.

Mironovskii, A. N. and Kas'yanov, A. N. 1987. Mnogomernyi analiz morfologicheskoi izmenchivosti plotvy - *Rutilus rutilus* (Cyprinidae) iz vodoemov SSSR [Multivariate analysis of morphological variations of the roach, *Rutilus rutilus* (Cyprinidae), from waters of the USSR]. Zoologicheskii Zhurnal, 66(3):393-401.

Mirshekari, S., Moeini, S., Bahri, A. H. and Safari, R. 2011. Evaluation of applicability of bacteriocine on increasing of shelf-life of Caspian roach (*Rutilus frisii kutum*) fillet stored at 4°C. Journal of Aquatic Animals and Fisheries, 2(6):57-64. In Farsi.

Mirshekari, S., Moeini, S., Bahri, A. H., Safari, R. and Saeidi Asl, M. R. 2010. Effect of bacteriocine Z and sodium benzoate on shelf-life of Caspian roach (*Rutilus frisii kutum*) fillet. Innovation in Food Science and Technology (Journal of Food Science and Technology), 2(1)(4):19-27. In Farsi.

Mirshekari, S., Safari, R., Adel, M., Motalebi Moghanjoghi, A. A., Khalili, E. and Bonyadian, M. 2016. Antimicrobial and antioxidant effects of nisin Z and sodium benzoate in vacuum packed Caspian kutum (*Rutilus frisii*) fillet stored at 4ºC. Iranian Journal of Fisheries Sciences, 15(2):789-901.

Mirza, M. R. 1969. Fishes of the genus *Cyprinion* Heckel (Cyprinidae, Osteichthyes) from West Pakistan. Pakistan Journal of Zoology, 1(2):141-150.
Mirza, M. R. 1971. Freshwater fishes of Makran, with a note on the swim-bladder of *Cyprinion microphthalmum* (Day). Pakistan Journal of Zoology, 3(2):240-242.
Mirza, M. R. 1972. Freshwater fishes of Baluchistan Province, Pakistan. Biologia, Lahore, 18(2):153-190.
Mirza, M. R. 1974. Freshwater fishes and ichthyogeography of Baluchistan and adjoining areas of the Indus Plain, Pakistan. Biologia, Lahore, 20(1):67-82.
Mirza, M. R. 1975. Freshwater fishes and zoogeography of Pakistan. Bijdragen tot de Dierkunde, 45(2):143-180.
Mirza, M. R. 1978. History of ichthyology in Pakistan. Biologia, Lahore, 24(2):305-348.
Mirza, M. R. 1980. The systematics and zoogeography of the freshwater fishes of Pakistan and Azad Kashmir. Proceedings of the 1st Pakistan Congress of Zoology, 1980:1-41.
Mirza, M. R. 1983. A review of natural history research in the Muslim World. National Science Council, Islamabad. 144 pp.
Mirza, M. R. 1986. Ichthyogeography of Afghanistan and adjoining areas. Pakistan Journal of Zoology, 18(4):331-339.
Mirza, M. R. 1989. Ichthyogeography of Pakistan and adjoining areas. Science International, Lahore, 1(3):199-207.
Mirza, M. R. 1990a. Pakistan main taza pani ki macchalian [Freshwater Fishes of Pakistan]. Urdu Science Board, Lahore. 128 pp. In Urdu.
Mirza, M. R. 1990b. Ichthyogeographical regions of Eurasia with a plea for the retention of name Oriental Region instead of Indian or Sino-Indian or Indoasiatic Region. Pakistan Journal of Zoology, 22(4):403-404.
Mirza, M. R. 1991a. A contribution to the systematics and biology of the snow-carps (Pisces, Cyprinidae, Schizothoracinae) of Pakistan. First Symposium on Fish and Fisheries of Pakistan, October, 19 - 20, 1991, Department of Zoology, Government College, Lahore, p. 29 (abstract).
Mirza, M. R. 1991b. A contribution to the systematics of the Schizothoracine fishes (Pisces: Cyprinidae) with the description of three new tribes. Pakistan Journal of Zoology, 23(4):339-341.
Mirza, M. R. 1992. A note on the fishes of the River Rakhshan with the record of *Garra rossica* (Nikolsky)(Pisces: Cyprinidae). Pakistan Journal of Zoology, 24(1):79.
Mirza, M. R. 1993. Pakistan ki Nachhlian aur Mahi Parvari [Fish and Fisheries of Pakistan]. 80 pp., colour plates.
Mirza, M. R. 1994a. A note on the fishes of the River Hingol, Pakistan. Pakistan Journal of Zoology, 26(2):181.
Mirza, M. R. 1994b. Geographical distribution of freshwater fishes in Pakistan: a review. Punjab University Journal of Zoology, 9:93-108.
Mirza, M. R. 1995. Distribution of freshwater fishes in Pakistan and Kashmir. Proceedings of Seminar on Aquaculture Development in Pakistan held at Fisheries Research & Training Institute, Manawan, Lahore, Pakistan, October, 17-18, 1993:1-15.
Mirza, M. R. 2000. A contribution to the fishes of the River Kurram with proposal of a new subfamily Aspidoparinae (Cyprinidae). Science International, Lahore, 12(4):355-357.
Mirza, M. R. 2003. Checklist of freshwater fishes of Pakistan. Pakistan Journal of Zoology Supplement Series, 3:1-30.

Mirza, M. R. 2006. Revised ichthyogeography of Pakistan and adjoining areas. Biologia, Lahore, 52(2):105-115.

Mirza, M. R. and Afridi, R. 2002. A note on the distribution of the snow-carps (Pisces: Cyprinidae: Schizothoracinae) in Pakistan and Kashmir. Pakistan Journal of Zoology, 34(2):171-173.

Mirza, M. R. and Ahmed, M. S. 2004. Distribution of freshwater fishes in Balochistan Province of Pakistan. Punjab University Journal of Zoology, 19:103-113.

Mirza, M. R. and Alam, M. K. 1994. A checklist of the freshwater fishes of Pakistan and Azad Kashmir. Science International, Lahore, 6(2):187-189.

Mirza, M. R. and Arshad, M. 2008 Status of *Labeo macmahoni* Zugmayer (Pisces: Cyprinidae). Pakistan Journal of Zoology, 40(6):465-466.

Mirza, M. R., Awan, K. M. and Javed, M. N. 1991. A contribution to the systematics of the fishes of the genus *Cyprinion* Heckel from Pakistan. First Symposium on Fish and Fisheries of Pakistan, October, 19 - 20, 1991, Department of Zoology, Government College, Lahore, p. 12 (abstract).

Mirza, M. R. and Bhatti, M. N. 1993. Pakistan ki Machhlian aur Mahi Parvari [Fish and Fisheries of Pakistan]. Part I. Ferozsons, Lahore. 184 pp. In Urdu.

Mirza, M. R., Hameed, S. and Naeem Javed, M. 1996. Fishes of Shadi Khoar (Baluchistan). Second Symposium on Fish and Fisheries of Pakistan, November, 25, 26, 1996, Department of Zoology, Government College, Lahore, pp. 8-9 (abstract).

Mirza, M. R. and Naeem Javed, M. 1985. A note on the mahseers of Pakistan with the description of *Naziritor*, new subgenus (Pisces: Cyprinidae). Pakistan Journal of Zoology, 17(3):225-227.

Mirza, M. R. and Naeem Javed, M. 1986. A contribution to the fishes of the genus *Tor* Gray (Pisces, Cyprinidae) from Pakistan and Azad Kashmir. Biologia, Lahore, Special Supplement, 1986:71-82.

Mirza, M. R. and Omer, T. 1984. A key to the identification of the freshwater fishes of Baluchistan. Biologia, Lahore, 30(1):73-91.

Mirza, M. R. and Saboohi, N. 1990. A note on the freshwater fishes of the River Dasht with the description of *Tariqilabeo* new subgenus (Pisces, Cyprinidae). Pakistan Journal of Zoology, 22(4):405-406.

Mirza, Z. B. and Khurshid, N. 2008. Baseline study of the birds of Hamun-e Mashkel and Tahlab River. Twenty-Eighth Pakistan Congress of Zoology (International), Government College, Faisalabad, 18-20 March 2008 (abstract).

Mirzaee, S. and Naderi, L. 2021. Determination the effects of replacing soybeen (*sic*) meal by canola meal on the growth of common carp (*Cyprinus carpio* Linnaeus, 1758). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.

Mirzaei, A., Azarm, H. and Layani, G. 2019. Prioritize the factors affecting the sustainability of Shadegan Wetland ecosystem stability index. Journal of Wetland Ecobiology, 10(4):69-80. In Farsi.

Mirzaei, B., Alizadeh Doughikollaee, E., Bahrami Kamangar, B. and Arshadi, A. 2016. Diversity and genetic structure of *Capoeta trutta* (Heckel, 1843) populations in the Kurdistan Province using Inter Simple Sequence Repeat markers. Journal of Fisheries (Iranian Journal of Natural Resources), 69(2):265-273. In Farsi.

Mirzaei, M. and Hasanian, H. 2013. Quality evaluation of Jajrood River (IRAN) by quality indices methods. Advanced Materials Research, 650:652-657.
Mirzaei, M., Khedri, J. and Ghashghaei, O. 2014. Survey of lernaeid in *Schizothorax zarudnyi* from Chahnimeh lakes in Sistan, Iran. Journal of Parasitic Diseases, 40(2):505-509.
Mirzaei, M. and Khovand, H. 2015. Prevalence of *Argulus foliaceus* in ornamental fishes (goldfish (*Carassius auratus*) and koi (*Cyprinus carpio*)) in Kerman, southeast of Iran. Journal of Parasitic Diseases, 39(4):780-782.
Mirzaei, M., Riahi-Bakhtiari, A., Salman-Mahini, A. and Gholamalifard, M. 2014. Analysis of the physical and chemical quality of Mazandaran province (Iran) rivers using multivariate statistical methods. Journal of Mazandaran University of Medical Sciences, 23(108):41-52. In Farsi.
Mirzaei, R., Abbasi, N. and Sakizadeh, M. 2017. Water quality assessment of rivers in Bushehr Province by using water quality index during 2011-2013 years. Iranian South Medical Journal, 20(5):470-480. In Farsi.
Mirzaei, R., Krami, M., Danehkar, A. Abdoli, A. and Conroy, J. 2010. Prey size selection of the Eurasian otter, *Lutra lutra* (Linnaeus, 1758), at the Jajrood River, Iran. Zoology in the Middle East, 50(1):19-25.
Mirzaei, S., Shabani, A., Shabanpour, B. and Imanpour, M. R. 2013. Effects of different levels of high unsaturated fatty acids (HUFA) on fish growth, hematocrit and some biochemical blood parameters in kutum (*Rutilus frisii kutum*). Journal of Utilization and Cultivation of Aquatics, 2(2):79-91. In Farsi.
Mirzaev, U. T. 1998. The morphology and ecology of *Schizothorax intermedius* McClelland (Cyprinidae) in water bodies of south Uzbekistan. Uzbekskii Biologicheshkii Zhurnal, 1998(6):38-41. In Russian.
Mirzaev, U. T. 2000a. A review of ecological features of fishes inhabiting Chatkal Biosphere Reserve in Uzbekistan. Turkish Journal of Zoology, 24(3):327-331.
Mirzaev, U. T. 2000b. Biodiversity of fishes in Uzbekistan: species diversity and endemism levels. Doklady Akademii Nauk Respubliki Uzbekistan, 8:49-52. In Russian.
Mirzajani, A. 2009. Study on the possibility of aquaculture activities in Choueir and Mirzakhanlou lake dam. Fisheries Management, Agriculture Organization, Zanjan Province.
Mirzajani, A., Ghane, A., Bagheri, S., Abbasi, K., Sayadrahim, M., Salahi, M. and Lavajoo, F. 2020. Diet survey and trophic position of *Macrobrachium nipponense* in the food web of Anzali Wetland. Wetlands, 40(5):1229-1239.
Mirzajani, A., Hamidian, A. H., Abbasi, K. and Karami, M. 2016. Distribution and abundance of fish in the southwest of Caspian Sea coastal waters. Russian Journal of Marine Biology, 42(2):178-189.
Mirzajani, A., Hamidian, A. H. and Pourang, N. 2020. Use of ^{13}C and ^{15}N for the determination of the metal flux in the Caspian Sea fishes. Isotopes in Environmental and Health Studies, 56(3):280-296.
Mirzajani, A., Naderi, S., Ganeh, A., Hadipour, E., Salahi M. and Javidpour, J. 2021. Trophic flexibility of Eurasian otter (*Lutra lutra*) in Anzali Wetland, Iran, assessed by fecal and stable isotope analysis. Aquatic Ecology, 55(2):401-415.
Mirzajani, A., Yosefzadeh, A. and Ganea, A. 1999. Zoobenthic invertebrate of Anzali Lagoon and their relation with organic matter of the bottom. Iranian Scientific Fisheries Journal, 7(4):83-102, 7. In Farsi.

Mirzajani, A. R. 2006. Controlling methods investigation of the Caspian Sea invasive Ctenophora (*Mnemiopsis leidyi*). Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bandar Anzali. http://en.ifro.ir (abstract).

Mirzajani, A. R. 2009. Limnological survey of Anzali Wetland data during 1990-2003 by use of GIS system. Iranian Fisheries Science Research Institute, Tehran. 123 pp. In Farsi.

Mirzajani, A. R. 2010. Limnological study of Taham Lake in Zanjan Province in order to assess aquaculture possibility. Iranian Fisheries Science Research Institute, Tehran. 81 pp. In Farsi.

Mirzajani, A. R., Abasi, K., Sabkara, J., Makaremi, M., Abedini, A. and Sayad Borani, M. 2012. Limnological study of mesotrophic Lake Taham in Zanjan Province. Iranian Journal of Biology, 25(1):74-89. In Farsi.

Mirzajani, A. R., Abdolmalaki, S., Daghigh Roohi, J., Babaei, H., Abedini, A. and Sayad Borani, M. 2020. Trophic status index and natural fisheries potential of some Iranian reservoirs. Iranian Journal of Fisheries Sciences, 19(6):2753-2769.

Mirzajani, A. R., Ghaninezhad, D. and Ghane Sasan Saraei, A 2005. The relation between fish catch values and macrobenthic biomass in Caspian Sea of Guilan province. Pajouhesh va Sazandegi, 18(3)(68):2-9. In Farsi.

Mirzajani, A. R., Hamidian, A. H. and Karami, M. 2016. Metal bioaccumulation in representative organisms from different trophic levels of the Caspian Sea. Iranian Journal of Fisheries Sciences, 15(3):1027-1043.

Mirzajani, A. R., Khoda Parast, H., Babaei, H., Abedini, A. and Dadi Ghandi, A. 2010. Eutrophication trend of Anzali Wetland based on 1992-2002 data. Journal of Environmental Studies, 35(52):19-21.

Mirzajani, A. R., Shiganaova, T., Finenko, G., Bagheri, S., Kideys, A. E. and Roohi, A. 2007. Reproduction of the ctenophore, *Beroe ovata*, in the Caspian Sea water. Iranian Journal of Fisheries Sciences, 6(2):93-104.

Mirzanjari, M. and Karami, P. 2018. Analysis of landscape degradation in the Hawizeh Wetland by using remote sensing. Journal of Wetland Ecobiology, 10(1):39-54. In Farsi.

Mirzargar, S. S., Soltani, M. and Rostami, M. 2000. Assessment of residues of some antibiotics in serum and tissues of common carp and rainbow trout using thin layer chromatography-bioautography (TLC-B). The Third World Fisheries Congress, Beijing, 31 Oct - 2 Nov 2000 (title).

Mirzapour Kouhdasht, A., Moosavi Nasab, M. and Aminlari, M. 2018. Investigation of characteristics of gelatin produced from common carp (*Cyprinus carpio*) wastes by enzymatic hydrolysis. Journal of Nutrition Sciences and Food Technology, 13(1):105-113. In Farsi.

Mirzergar, S. S. and Kulivand, A. 2017. Investigation and identification of fish parasites of Kahman River in Sole district. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Misaghi A., Akhondzadeh Basti, A. and Zahrae Salehi, T. 2003. The study of fungi and bacterial pathogens in salted fish in Iran. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).

Misra, K. S. 1949. On a second collection of fish from Iraq. Records of the Indian Museum, 45(2-3)(1947):115-127.

Mitchell, K. and Staff. 1980. Appendix L. Agriculture, Fishing, and Pearls, pp. 652-666. In:

Cottrell, A. J. The Persian Gulf States. A General Survey. The Johns Hopkins University Press, Baltimore and London. xxxiv + 695 pp.
Mitrofanov, I. V. 1994. The origins and systematics of the dace genus *Leuciscus* Agassiz (Cyprinidae) in Central Asia and Kazakhstan. Journal of Ichthyology, 34(3):104-113.
Mitrofanov, I. V. and Mamilov, N. Sh. 2015. Fish diversity and fisheries in the Caspian Sea and Aral-Syr Darya basin in the Republic of Kazakhstan at the beginning of the 21st Century. Aquatic Ecosystem & Health Management, 18(2):160-170.
Mitrofanov, V. P., Dukravets, G. M., Mel'nikov, V. A. and Baimbetov, A. A. 1988. Fishes of Kazakhstan. Volume 3, Carps. Nauka, Alma Ata. 303 pp. In Russian.
Mittermeier, R. A., Gil, P. R., Hoffman, M., Pilgrim, J., Brooks, T., Mittermeier, C. G., Lamoreux, J. and da Fonseca, G. A. B. 2004. Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. CEMEX Conservation Book Series 12, Mexico City. 390 pp.
Moazzeni Jola, B. and Roominai, L. 2018. Effect of chitosan extracted from shrimp (*Metapenaeus affinis*) on the shelf life of grass carp (*Ctenopharyngodon idella*) fillet in vacuum packaging. Journal of Fisheries (Iranian Journal of Natural Resources), 70(3):295-308. In Farsi.
Mobaraki, A. 2015. Sustainable management and conservation of the mugger crocodile (*Crocodylus palustris*) in Iran. M.Sc. in Management and Conservation of the Species in Trade: the International Framework, 11th Edition, International University of Andalusia, Baeza, Spain. 51 pp.
Modaresi, R., Mardani, K., Tukmechi, A. and Ownagh, A. 2011. Prevalence of *Listeria* spp. in fish obtained from Urmia fish markets. African Journal of Microbiology Research, 5(30):5398-5401.
Modarres, R. 2006. Regional precipitation climates of Iran. Journal of Hydrology (New Zealand), 45(1):13-27.
Moeini, S. 1989. Fisheries Products Industries. Iranian Fisheries Research and Training Organization, Tehran. 212 pp.
Moeini, S. and Daneshnuran, B. 2001. Production of cold marinade from roach (*Rutilus rutilus*). Iranian Journal of Natural Resources, 54(1):63-73. In Farsi.
Moeini, S., Delroushan, M., Kouchakian Sabour, A. and Asgari Sari, A. A. F. 2008. A comparative assessment of the effects of fresh and saltwater on soluble proteins and surimi made from *Hypophthalmichthys molitrix*. Iranian Scientific Fisheries Journal, 17(3):143-152. In Farsi.
Moeini, S., Rahimzade, E. and Khanipour, A. A. 2009. Enrichment of rotchen bread by fish protein concentrate of silver carp (*Hypophthalmichthys molitrix*). Journal of Marine Science and Technology Research, 4(2):1-9. In Farsi.
Moeini Jazani, M., Ebrahimzadeh Mosavi, H., Rahmati Holasoo, H., Barzegar, M., Soltani, M. and Taheri Mirghaed, A. 2017. A survey on monogeneans parasites infestation of goldfish emphasizing the farming carp species. Journal of Veterinary Research, 72(2):207-212. In Farsi.
Moeini Jazani, M., Ebrahimzadeh Mousavi, H. A., Rahmati-Holasoo, H., Taheri Mirghaed, A. and Bozorgnia, A. 2019. Isolation and identification of Siahrood European chub (*Squalius cephalus* Linnaeus, 1758) parasites, Mazandaran Province. Journal of Veterinary Research, 74(4):484-492. In Farsi.
Moezi, S. A. and Keivany, Y. 2020. Osteology of the Caspian fish *Chondrostoma cyri* (Kessler,

1877). Journal of Aquatic Ecology, Hormozgan University, 9(4):50-58. In Farsi.
Moezi, S. A., Keivany, Y. and Dorafshan, S. 2019. Descriptive osteology of *Chondrostoma regium* (Heckel, 1843) in Tigris basin. Journal of Fisheries (Iranian Journal of Natural Resources), 72(2):195-210. In Farsi.
Moëzzi, F., Poorbagher, H. and Eagderi, S. 2018. Evaluating effects of model type and importance of habitat parameters on prediction of biodiversity indices (A case study with fishes of the Totkabon River in the southern Caspian Sea). Journal of Fisheries (Iranian Journal of Natural Resources), 71(3):225-235. In Farsi.
Moezzi, S. A., Keivany, Y. and Elvira, B. 2020. Comparative osteology of *Chondrostoma orientale* and *C. nasus*. Nova Biologica Reperta, 7(3):278-284. In Farsi.
Moghadam, F. 1974. The blue-green algae of Geno Hot Spring (Iran). Bulletin of the Faculty of Science, Tehran University, 6(2):78-83.
Moghadam, F. 1976. Diatoms as indicator of pollution Zayandeh River, Iran. Proceedings of the Academy of Natural Sciences, Philadelphia, 127(19):281-297.
Moghadamm, A. K. 2006. Qualitative and quantitative survey of bonyfishes fingerlings being released as stocking material in southern Caspian Sea Guilan Province in 2002. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bandar Anzali. http://en.ifro.ir (abstract).
Moghaddam, A., Oryan, S. and Shabanipour, N. 2014. Comparative study on the structure of zona radiata in pre- and post- fertilized mature eggs of the viviparous molly (*Poecilia sphenops*) and the oviparous bighead carp (*Hypophthalmichthys nobilis*). Journal of the Persian Gulf, 5(18):57-62.
Moghadamnia, F., Hashemzadeh Segherloo, I. and Nikookhah, F. 2015a. Morphologic comparison of the two cyprinid species in upstream and downstream of the Zayandehroud dam. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 81
Moghadamnia, F., Hashemzadeh Segherloo, I. and Nikookhah, F. 2015b. Effects of habitat on scale structure of fishes in upstream and downstream of Zayandehroud dam. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 145.
Moghaddas, S. D., Abdoli, A., Hasanzadeh Kiabi, B. and Rahmani, H. 2020. Risk assessment of the potential invasiveness of *Coptodon zillii* (Gervais, 1848) in Anzali Wetland using AS-ISK Model. Environmental Sciences, 18(2):255-270. In Farsi.
Moghaddas, S. D., Abdoli, A., Kiabi, B. H., Rahmani, H., Vilizzi, L. and Copp, G. H. 2021. Identifying invasive fish species threats to RAMSAR wetland sites in the Caspian Sea region - A case study of the Anzali Wetland complex (Iran). Fisheries Management and Ecology, 28(1):28-39.
Moghaddasi, B. 2015. Effects of the dietary synbiotic 'BiominImbo' on growth and feeding indices in goldfish (*Carassius auratus*). Middle East Aquaculture Forum, Dubai International Convention and Exhibition Center, Dubai, United Arab Emirates, 5-6 April 2015 (abstract).
Moghainemi, R. S. and Abbasi, S. 1992. Parasitic fauna of economically important fishes from Hoor-Elazim Marsh. Iranian Fisheries Research and Training Organization Publication, Tehran. iv + 107 pp. In Farsi.
Moghdani, S., Amiri, F., Ghanbari, F., Saki Entezami, M., Tabatabaei, T. and Pourkhan, M. 2013. Water quality assessment with biological indicators: Mond protected area, Iran.

Journal of Biodiversity and Environmental Sciences, 3(9):80-89.
Moghim, M., Ghani Nezhad, G. and Fazli, F. 1994. Stock assessment of the Caspian Sea bony fishes. Iranian Fisheries Journal, 3(1):35-52, 4. In Farsi.
Moghim, M. and Rouhi, A. A. Gh. 2009. Distribution and abundance of the invasive ctenophore *Mnemiopsis leidyi* in the littoral waters of the Caspian Sea, Iran. Iranian Scientific Fisheries Journal, 17(4):169-173. In Farsi.
Moghinami, R. 1995. Investigation of fish parasites in Houralazim Lagoon, Azadegan Plain. Project Report, Fisheries Research Organization, Khuzestan Province, Ahvaz, 107 pp.
Mohadasi, M., Eagderi, S., Shabanipour, N., Sadat Hosseinzadeh, M., AnvariFar, H. and Khaefi, R. 2014. Allometric body shape changes and morphological differentiation of shemaya, *Alburnus chalcoides* (Guldenstadf (*sic*), 1772), populations in the southern part of Caspian Sea using Elliptic Fourier analysis. International Journal of Aquatic Biology, 2(3):164-171.
Mohadasi, M., Shabanipour, N. and Eagderi, S. 2013. Habitat-associated morphological divergence in four shemaya, *Alburnus chalcoides* (Actinopterygii: Cyprinidae) populations in the southern Caspian Sea using geometric morphometrics analysis. International Journal of Aquatic Biology, 1(2):82-92.
Mohaddasi, M., Shabanipour, N. and Abdolmaleki, S. 2013. Morphometric variation among four populations of shemaya (*Alburnus chalcoides*) in the south of Caspian Sea using truss network. The Journal of Basic & Applied Zoology, 66(2):87-92.
Mohaghegh, M. R. 2002. Recognition of fishes in rivers and basins of Qom. Agriculture and Natural Resources Research Centre of Qom, Iranian Fisheries Research Organization, Ministry of Jihad-e Agriculture. 65 pp. In Farsi.
Mohaghegh, M. R. 2008. Recognition of fishes in rivers and basin of Qom. Agriculture and Natural Resources and Agriculture Research Center of Qom Province, Iranian Fisheries Research Organization, Ministry of Jihad-e Agriculture. 60 pp. In Farsi.
Mohaghegh, M. R., Valinasab, T. and Parafkandeh, F. 2014. Evaluation of otolith shape of Caspian kutum, *Rutilus frisii kutum* and determining the age using ear stone cutting. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Mohagheghi Samarin, A. 2010. *In vivo* and *in vitro* storage of kutum, *Rutilus frisii kutum* eggs. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 72 pp. In Farsi.
Mohagheghi Samarin, A., Policar, T., Kazemi, R. and Nikbakhsh, J. 2013. Survival rates associated with the in vitro low temperature storage of kutum *Rutilus frisii kutum* eggs. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Mohajeri, S., Horlemann, L., Sklorz, S., Kaltofen, M., Ghanavizchian, S. and von Voigt, T. N. 2016. Integrated water resource management in Isfahan: The Zayandeh Rud catchment, pp. 603-627. In: Borchardt, D., Bogardi, J. J. and Ibisch, R. B. (Eds.). Integrated Water Resources Management: Concept, Research and Implementation. Springer, Heidelberg. xv + 781 pp.
Mohajeri Borazjani, J., Bagherpour, A., Soleymani, A. and Mobedi, I. 2017. Helminthes parasites isolated from a cyprinid fish, (*Capoeta barroisi* (Lortet, 1894)) in the Dalaki River, Boushehr province, Iran. Iranian Journal of Aquatic Animal Health, 3(1):90-100.
Mohamadi, M., Choobkar, N., Rezaie Manesh, M. and Kakoolki, S. 2019. Rehabilitation of

Shadegan Lagoon, aquaculture opportunity and dust inhibiting with Khuzestan Sugarcane Industry drainage. Journal of Utilization and Cultivation of Aquatics, 7(4):29-40. In Farsi.

Mohamadi, M., Zamini, A. A. and Vahabzadeh Roodsari, H. 2014. Evaluation anti-bacterial and anti-fungal effects of *Eucalyptus globulus* labill (*sic*) hydroalcoholic extract on the skin and gills of common carp fingerlings (*Cyprinus carpio*). Journal of Aquatic Animals and Fisheries, 4(16):63-69. In Farsi.

Mohamadi, R. 1997. Investigation of fish parasites in Mahabad Dam Lake. Doctor of Veterinary Medicine Thesis, University of Urmia, Urmia. 112 pp.

Mohamadi Champiri, Y., Chelemal Dezfoulnejad, M. and Mesbah, M. 2016. Study on the effect of different levels of vitamin D on the parameters thyroxine in *Cyprinus carpio*. Journal of Applied Biology, 30(2):185-196. In Farsi.

Mohamadian, Kh., Sadooghi, M., HoseinzadehSahafi, H. and Mosavi, H. 2013. Effect of mercury chloride on embryonic stages and gill differentiation in *Rutilus frisii kutum*. Journal of Aquaculture Development, 7(2):87-99. In Farsi.

Mohamadian, S., Rezvani Gilkolaei, S., Kazemian, M., Kamali, A., Rouhollahi, Sh., Taghavi, M. J. and Laloei, F. 2011. A study on population genetics of *Vimba vimba persa* (Pallas, 1814) using microsatellite markers in Gilan Province, the southern Caspian Sea. Journal of Fisheries (Iranian Journal of Natural Resources), 64(2):145-152. In Farsi.

Mohamadian, S., Rezvani Gilkolaei, S., Kazemian, M., Kamali, A., Taghavi, M. J., Rouholahi, S., Laloei, F. and Nayerani, M. 2011. The study of genetic diversity and population structure of *Vimba vimba persa* (Pallas, 1814) populations in the eastern and western coastline of the Caspian Sea (Havigh River and Gorganroud River) using microsatellite markers. Journal of Taxonomy and Biosystematics, 2(5):29-38.

Mohamadian, S., Rezvani Gilkolaei, S., Rouhollahi, S., Taghavi, M. J., Nayerani, M., Shirzad, E. and Taheri Mirghaed, A. 2012. Genetic characterization of *Vimba vimba persa* (Pallas, 1814) in southern parts of the Caspian Sea using microsatellite markers. Iranian Journal of Fisheries Sciences, 11(2):347-357, 354.

Mohamadian, S., Rezvani Gilkolaei S., Soltani, M., Rouholahi, S., Ghodratnama, M. and Taheri Mirghaed, A. 2012. Microsatellite-based genetic diversity and differentiation of Caspian *Vimba*. XIV European Congress of Ichthyology, Liège, Belgium, 3-8 July 2012 (poster).

Mohamadiyani, V. and Keivany, Y. 2015. Length-weight relationship in *Capoeta aculeata* from Gizehrud River in Noorabad, Lorestan Province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 124.

Mohamadrezaei, D., Mojazi Amiri, B., Nematollahi, M. A., Makhdoumi, C. and Hashemi, S. S. 2017. Effect of genistein and β-sitosterol on some reproduction factors of Caspian kutum (*Rutilus kutum*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(4):452-461. In Farsi.

Mohamadzadeh, P. and Gamili, S. 2014. Effect of $PbNO_3$ on gill and liver tissues in *Rutilus rutilus*. Journal of Applied Biology, 27(1):79-96. In Farsi.

Mohamed, A-R. M. 2014. The status of himri fish, *Barbus luteus* (Heckel) population in the Al-Huwazah Marsh, south Iraq. Journal of Zankoy Sulaimani, Part A, Special Issue, 16:303-314.

Mohamed, A-R. M. and Abood, A. N. 2016. Occurrence of the king nase, *Chondrostoma regium* (Heckel, 1843) in the Shatt Al-Arab River, Iraq. IOSR Journal of Agriculture and Veterinary Science, 9(8):85-89.

Mohamed, A-R. M. and Abood, A. N. 2017a. Dispersal of exotic fish in the Shatt Al-Arab River, Iraq. IOSR Journal of Agriculture and Veterinary Science, 10(8):50-57.

Mohamed, A-R. M. and Abood, A. N. 2017b. Ecological health assessment of the Shatt Al-Arab River, Iraq. IOSR Journal of Agriculture and Veterinary Science, 10(10):1-8.

Mohamed, A-R. M. and Abood, A. N. 2018. Diet and trophic status of three cyprinids fish in the Shatt Al-Arab River, Iraq. IOSR Journal of Agriculture and Veterinary Science,11(7):49-57.

Mohamed, A-R. M. and Abood, A. N. 2021. Trophic relationships among fourteen native and non-native fish species in the Shatt Al-Arab River, Iraq. World Journal of Advanced Research and Reviews, doi:10.30574/wjarr. 2021.11.1.0345.

Mohamed, A-R. M., Abood, A. N. and Jawad, L. A. 2017. Presence of *Carasobarbus sublimus* (Coad & Najafpour, 1997) in the upper reaches of Shatt al-Arab River, Basrah, Iraq. Zoology and Ecology, 27(1):30-34.

Mohamed, A. R. M., Al-Hassan, L. A. J. and Ali, T. S. 1993. The presence of a cyprinid fish, *Barbus luteus* in marine waters of Iraq. Arquivos do Museu Bocage, nova série, 2(25):415-416.

Mohamed, A-R. M. and Al-Jubouri, M. O. A. 2018. Occurrence of cyprinid fish, *Carasobarbus sublimus* in the Al-Diwaniya River, Middle Euphrates, Iraq. Journal of Biodiversity and Environmental Sciences, 12(1):63-72.

Mohamed, A-R. M. and Al-Jubouri, M. O. A. 2019. Observations on the biological properties of the cyprinid fish, *Carasobarbus sublimus* in the Al-Diwaniya River, Middle Euphrates, Iraq. IOSR Journal of Agriculture and Veterinary Science, 12(1):38-44.

Mohamed, A-R. M. and Al-Jubouri, M. O. A. 2020a. Biological properties of *Luciobarbus xanthopterus* in the Al-Diwaniya River, middle of Iraq. International Journal of Fisheries and Aquatic Studies, 8(1):92-98.

Mohamed, A-R. M. and Al-Jubouri, M. O. A. 2020b. A comparison study on growth, reproductive and food habit of *Mesopotamichthys sharpeyi* in the Al-Diwaniya River, middle of Iraq. International Journal of Fisheries and Aquatic Studies, 8(2):49-56.

Mohamed, A-R. M. and Al-Jubouri, M. O. A. 2020c. A study on age, growth, reproduction, and diet of *Leuciscus vorax* (Heckel, 1843) in Al-Diwaniya River, middle of Iraq. World Journal of Advanced Research and Reviews, 5(3):25-37.

Mohamed, A-R. M., Aufy, L. A. and Jasim, B. M. 2015. Some biological aspects of the bleak, *Alburnus mossulensis* in the southern reaches of Euphrates River, Iraq. Asian Journal of Applied Sciences, 3(2):277-285.

Mohamed, A-R. M., Aufy, L. A. and Jasim, B. M. 2016. Food habit of Mussol bleak, *Alburnus mossulensis* (Heckel, 1843) in the southern reaches of Euphrates River, Iraq. Basrah Journal of Agricultural Sciences, 29(2):587-593.

Mohamed, A. R. M. and Barak, N. A. 1988. Seasonal variations in some limnological features of the Garma Marshes. Basrah Journal of Agricultural Sciences, 1(1):56-63.

Mohamed, A-R. M. and Hameed, E. K. 2019. Impacts of saltwater intrusion on the fish assemblage in the middle part of Shatt Al-Arab River, Iraq. Asian Journal of Applied Sciences, 7(5):577-586.

Mohamed, A. R. M., Hussain, N. A., Al-Noor, S. S., Mutlak, F. M., Al-Sudani, I. M., Mojer, A. M., Toman, A. J. and Abdad, M. A. 2008. Fish assemblage of restored Al-Hawizeh marsh, southern Iraq. Ecohydrology and Hydrobiology, 8(2-4):375-384.

Mohamed, A-R. M., Hussein, S. A. and Mutlak, F. M. 2015. Some biological characteristics of

the fish himri, *Barbus luteus* (Heckel, 1843) in eastern side of Hammar Marsh, Iraq. Jordan Journal of Agricultural Sciences, 11(2):551-563. In Arabic.

Mohamed, A-R. M., Hussein, S. A. and Mutlak, F. M. 2017. Some biological aspects of four fish species in East Hammar Marsh, Iraq. Journal of Scientific and Engineering Research, 4(8):278-287.

Mohamed, A-R. M., Lazem, L. F. and Hussein, S. A. 2017. Assessment of water quality and fish species dominance in the Shatt Al-Arab River by GIS technique. Journal of Scientific and Engineering Research, 4(8):213-220.

Mohamed, A-R. M., Resen, A. K. and Taher, M. M. 2012. Longitudinal patterns of fish community structure in the Shatt Al-Arab River, Iraq. Basrah Journal of Science, 30(2):65-86

Mohamed, M. B. M. 1965. Preliminary observations on some chemico-physical features of the Shatt Al-Arab estuary. Proceedings of the Iraqi Science Society, 6:34-40.

Mohamed, M-B. M. 1966. Further observations on some environmental conditions of Shatt Al-Arab. Bulletin of the Biological Research Centre, Baghdad, 1(1965):71-79.

Mohammad Alikhani, M., Farokhrouz, M., Zamini, A. A., Lameei Hassankiadeh, S. and Poshtpanah, S. 2013. Determination acute toxicity of the captan fungicide (LC_{50}96H) and its effects on blood factors fingerling grass carp (*Ctenopharyngodon idella*). Journal of Fisheries, 7(3):25-34. In Farsi.

Mohammad Nejad, M., Rahimi, A. and Akrami, R. 2019. The impact of different levels of vitamins C and E on growth and survival of carp (*Cyprinus carpio*). Journal of Applied Ichthyological Research, 7(3):143-154. In Farsi.

Mohammad Nejad Shamoushaki, M. 2010. Effect of organophosphate, diazinon on some immunophysiological, haematological and histological variables of *Rutilus frisii kutum* (Kamensky, 1901). Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 129 pp. In Farsi.

Mohammad Nejad Shamoushaki, M. 2012. Effect of feeding frequency on growth performances and survival of *Rutilus rutilus caspicus*. Journal of Research in Biology, 2(3):200-205

Mohammad Nejad Shamoushaki, M., Assareh, R., Samadian, M. and Pajand, Z. 2010. Determining the lethal concentrations (LC50/96H) of herbicide roundup (glyphosate) on *Rutilus frisii kutum*, *Rutilus rutilus caspicus* and *Cyprinus carpio*. Journal of Biology Science, 4(1)(series no. 12):79-86.

Mohammad Nejad Shamoushaki, M., Dordee, Kh., Rezaei Shirazi, A. and Yahiaee, M. 2013. Study of trend process of (*Rutilus frisii kutum*), (*Liza* spp.) and (*Cyprinus carpio*) in provinces of Golestan, Mazandaran and Guilan (2009-2011). Journal of Aquatic Animals and Fisheries, 4(15):27-38. In Farsi.

Mohammad Nejad Shamoushaki, M., Esmaeili, Kh. and Shakiba, M. M. 2011. Effect of starvation and compensatory growth on growth and survival of *Rutilus frisii kutum* (Kamensky, 190). Journal of Aquatic Animals and Fisheries, 1(4):45-52. In Farsi.

Mohammad Nejad Shamoushaki, M., Gilani, Gh. R. and Yahiaee, M. 2013. Review of catch process of kutum, mullet, common carp and roach during 1999 to 2008 in Golestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 7(2):61-68. In Farsi.

Mohammad Nejad Shamoushaki, M. and Hojjati, V. 2014. The study of hematology and some of blood serum factors in Caspian carp, *Cyprinus carpio*. Journal of Animal Biology, 6(3):63-70. In Farsi.

Mohammad Nejad Shamoushaki, M., Karbakhsh Ravari, A. and Mazini, M. 2013. Effect of different stocking density on growth and survival rate of *Rutilus frisii kutum* (Kamensky, 1901). Journal of Marine Biology, 4(4):59-70. In Farsi.

Mohammad Nejad Shamoushaki, M., Khari, Z. and Eslami, Z. 2012. Determination of optimum feeding rate for growth of Caspian carp, *Cyprinus carpio* (Linnaeus, 1758). AACL Bioflux, 5(3):136-141.

Mohammad Nejad Shamoushaki, M., Mallah, A-R., Mazini, M. and Manoochehri, F. 2014. The determination of some blood serum biochemistry parameters in *Cyprinus carpio*, *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella*. Aquaculture Europe 2014, Donostia-San Sebastián, Spain, October 14-17, 2014 (abstract).

Mohammad Nejad Shamoushaki, M. and Mazini, M. 2012a. Effect of probiotic bakery yeast (*Saccharomyces cerevisiae*) on growth and survival of *Rutilus rutilus caspicus*. Journal of Aquaculture Development, 6(1):103-111. In Farsi.

Mohammad Nejad Shamoushaki, M. and Mazini, M. 2012b. Determination of optimum temperature for growth of *Rutilus rutilus caspicus*. Journal of Animal Physiology and Development (Journal of Biological Sciences). 5(4):17-27. In Farsi.

Mohammad Nejad Shamoushaki, M. and Mazini, M. 2013. Effect of starvation and compensatory growth with *Saccharomyces cerevisiae* on growth and survival of *Cyprinus carpio* (Linnaeus, 1758). Journal of Aquatic Animals and Fisheries, 4(14):35-41. In Farsi.

Mohammad Nejad Shamoushaki, M., Riahee, S. and Mazinee, M. 2011. Effect of rearing tank color on fish survival and growth factors on *Cyprinus carpio*. Journal of Aquatic Animals and Fisheries, 2(7):71-78. In Farsi.

Mohammad Nejad Shamoushaki, M. and Shahkar, E. 2018. Determination of lethal concentration (Lc50 96 H) of chloropyrifos (*sic*) and diazinon on (*Rutilus Rutilus Caspicus*) (*sic*). New Technologies in Aquaculture Development (Journal of Fisheries), 12(1):1-7. In Farsi.

Mohammad Nejad Shamoushaki, M., Soltani, M., Kamali, A., Imanpoor, M. R., Sharifpour, I. and Khara, H. 2012. Effects of organophosphate, diazinon on some haematological and biochemical changes in *Rutilus frisii kutum* (Kamensky, 1901) male brood stocks. Iranian Journal of Fisheries Sciences, 11(1):105-117.

Mohammad Nejad Shamoushaki, M., Soltani, M., Sharifpour, I. and Imanpoor, M. R. 2011a. The study of diazinon effects on haematological factors of *Rutilus kutum* male brood stocks. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 5(3):23-32. In Farsi.

Mohammad Nejad Shamoushaki, M., Soltani, M., Sharifpour, I. and Imanpoor, M. R. 2011b. Effects of sublethal concentrations diazinon on hormonal variable of *Rutilus frisii kutum* (Kamensky, 1901) male brood stocks. Veterinary Research (Garmsar Branch), 7(21)(supplementary):7-11. In Farsi.

Mohammad Nejad Shamoushaki, M., Soltani, M., Sharifpour, I., Imanpour, M. R., Baharlouei, A. and Naieme, M. E. 2011. Study effects sublethal concentration of diazinon on testis, brain and heart of *Rutilus frisii kutum* (Kamensky, 1901) male brood stocks. Veterinary Clinical Pathology (Veterinary Journal Tabriz), 5(3):1287-1294. In Farsi.

Mohammad Shafiee, M. R. 2001. The residue measurement of pesticide in water and biota of the Sorkhrood River in the south of the Caspian Sea. Ph.D. Thesis, Islamic Azad University, Tehran, 280 pp. In Farsi.

Mohammadi, A., Ghasemzadeh-Mohammadi, V., Haratian, P., Khaksar, R. and Chaichi, M.

2013. Determination of polycyclic aromatic hydrocarbons in smoked fish samples by a new microextraction technique and method optimisation using response surface methodology. Food Chemistry, 141(3):2459-2465.

Mohammadi, F., Askari Hesni, M., Teimori, A. and Madjdzadeh, S. M. 2015. Intraspecific variations in *Capoeta fusca* Nikolskii, 1897 (Cyprinidae) based on qualitative and quantitative analyses of otolith morphology. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 105-106.

Mohammadi, F., Askari Hesni, M., Teimori, A. and Madjdzadeh, S. M. 2018. The urohyal bone and asteriscus morphology in *Capoeta saadii* (Heckel 1847) collected from the Kerman basin. Aquatic Physiology and Biochemistry, 5(4):113-135. In Farsi.

Mohammadi, F., Mesbah, M. and Razijalali, M. 2019. Morphological survey of the helminth parasites in the abdominal cavity and eyes of *Mesopotamichthys sharpeyi* and *Barbus grypus* from Shadegan Wetland of Khuzestan province. Journal of Animal Environment, 11(1):151-160. In Farsi.

Mohammadi, G. and Marammazi, J. Gh. 2001. Comparison of biomass of Cyprinidae and Mugilidae in the fish community of Shadegan Marsh. The First National Symposium on *Barbus* fishes of Iran, 9-10 January 2001, Khuzestan Fisheries Research Centre, Ahvaz. 50 pp. In Farsi.

Mohammadi, G., Mesbah, M., Khadjeh, Gh. and Mombeini, A. 2017. Effects of total protein and cholesterol on spermatology traits of common carp (*Cyprinus carpio*). Journal of Marine Sciences and Technology, 16(1):66-75. In Farsi.

Mohammadi, H. 2016. Limnological study and biomass assessment of culture-based Chinese carps in Golbolagh Reservoir, Kordestan Province. Ph.D. Thesis, University of Gorgan. In Farsi.

Mohammadi, H., Paighambari, S. Y., Abdolmalekim S., Fallahi, M., Ghorbani, R. and Hossaini, S. A. 2017. Trophic status and fish production potential of Golbolagh Lake (west of Kurdistan Province). Journal of Aquatic Ecology, 7(1):126-139. In Farsi.

Mohammadi, M., Askary Sary, A. and Khodadadi, M. 2011. Cadmium and lead levels in muscle and liver of *Barbus grypus* in Dez River. Journal of Wetland Ecobiology, 1(4):91-96. In Farsi.

Mohammadi, M., Askary Sary, A. and Khodadadi, M. 2012. Accumulation variations of selected heavy metals in *Barbus xanthopterus* in Karoon and Dez Rivers of Khuzestan, Iran. Iranian Journal of Fisheries Sciences, 11(2):372-382.

Mohammadi, M., Cheleh Mal Dezfooli Nezhad, M. and Mesbah, M. 2018. The effect of ethanolic extract of *Lawsonia inermis* on the hematological parameters in *Cyprinus carpio*. Journal of Animal Biology, 10(3):55-63. In Farsi.

Mohammadi, M., Mahboobi Soofiani, N. A., Farhadian, O. and Malekpouri, P. 2018. Effects of different thermal acclimations on metabolic rate of brond-snout (*sic*) *Chondrostoma regium*. Journal of Animal Researches (Iranian Journal of Biology), 31(1):109-121. In Farsi.

Mohammadi, M., Sattari, M., Babakhani, A., Johari, S. A. and Ghafoori, H. 2018. Effects of iron oxide nanoparticles on the antioxidant defense system and lipid peroxidation of liver in common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(4):325-330. In Farsi.

Mohammadi, M., Soltani, M., Siahpoosh, A. and Shamsaie, M. 2018. Effects of dietary supplementation of date palm (*Phoenix dactylifera*) seed extract on body composition,

lipid peroxidation and tissue quality of common carp (*Cyprinus carpio*) juveniles based on total volatile nitrogen test. Iranian Journal of Fisheries Sciences, 17(2):394-402.

Mohammadi, M., Soofiani, N. M., Farhadian, O. and Malekpouri, P. 2019. Metabolic and NH_4 excretion rate of fresh water species, *Chondrostoma regium* in response to environmental stressors, different scenarios for temperature and pH. Science of the Total Environment, 648:90-1012.

Mohammadi, N., Hosseini Shekarabi, S. P. and Shamsaie Mehrgan, M. 2018. Effect of dietary phytase and wheat bran on some growth performances and phosphorus absorption function of common carp (*Cyprinus carpio*) fry. Iranian Scientific Fisheries Journal, 27(3):75-83. In Farsi.

Mohammadi, Z., Mohammadiazarm, H., Salati, A. and Rajabzadeh, E. 2016. Effect of different levels of dietary niacin on the gut and liver histology and some liver enzymes activity of juveniles common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(2):253-263. In Farsi.

Mohammadi Arani, M., Staki, A. A., Allameh, S. K. and Daniali, S. R. 2003. Evaluation of particles abundance and digestion in silver carp. Pajouhesh va Sazandegi, 16(1)(58):84-86. In Farsi.

Mohammadi Galangash, M. 2021. Heavy metals pose a serious threat to biota and the environment of Anzali wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 5 pp. In Farsi.

Mohammadi Makvandi, Z., Kochnian, P. and Pasha Zanosi, H. 2012a. Effect of salinity stress on body composition of silver carp fingerlings (*Hypophthalmichthys molitrix*). Journal of Aquatic Animals and Fisheries, 3(10):61-67. In Farsi.

Mohammadi Makvandi, Z., Kochnian, P. and Pasha Zanosi, H. 2012b. Effect of salinity on growth and survival in fingerling silver carp (*Hypophthalmichthys molitrix*). Journal of Aquatic Animals and Fisheries, 3(11):19-26. In Farsi.

Mohammadi Movahed, M., Babakhani, A., Sattari, M., Ghafouri, H. and Johari, S. A. 2019. Effects of iron oxide nanoparticles (Fe_2O_3) on the antioxidant defense system and lipid peroxidation in the gill of juvenile common carp (*Cyprinus carpio*). Aquatic Physiology and Biotechnology, 7(1):39-52. In Farsi.

Mohammadi Nefchi, F., Mohammadi Azar, H., Yavari, V., Soleati, A. P. and Zangi, N. 2019. Digestive enzymes activity, body composition and biochemical blood factor of juvenile binni fish *Mesopotamichthys sharpeyi* (Günther, 1874) fed soybean meal and baker's yeast. Journal of Applied Ichthyological Research, 6(3):129-142. In Farsi.

Mohammadi Otaghsara, O. K., Ghobadi, S., Hosseini Fard, S. M., Ramshger, M. and Fallah, E. 2017. Isolation and identification of the *Lactobacillus casei* from the intestinal silver carp (*Hypophthalmichthys molitrix*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 415-419. In Farsi.

Mohammadi Otaghsra, O. K., Karbalai Aghazadeh, N., Agha Pour Gharakheli, M. M. and Alinejad Moalem, S. 2017. The effect of diazinon on blood parameters of *Cyprinus carpio*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 392-397. In Farsi.

Mohammadi Rouzbahani, M., Roghani Zadeghan, N. and Harirforoush, A. 2015. Assessment of river ecological quality using B-IBI (Dez River, southwestern of Iran). International Journal of Environmental Science and Development, 6(10):746-749.

Mohammadi Sarpiri, K., Mahboobi Soofiani, N., Ebrahimi, E., Keivany, Y. and Malekpouri, P. 2016. Effect of diet-borne copper and zinc on serum parameters related to bone metabolism in common carp (*Cyprinus carpio*). Journal of Aquaculture Sciences, 3(1):82-92. In Farsi.

Mohammadi-Sarpiri, K., Keivany, Y. and Dorafshan, S. 2021. Descriptive osteology of *Alburnoides holciki* (Teleostei: Cyprinidae) from Iran. FishTaxa, 20:39-47.

Mohammadi-Sapiri, K., Soofiani, N. M., Ebrahimi, E., Keivany, Y. and Malekpouri, P. 2016. Hematological changes following copper and zinc manipulations in the common carp (*Cyprinus carpio*) diet. Iranian Journal of Ichthyology, 3(2):130-139.

Mohammadi-Zadeh Khoshroo, M., Shamsaie Mehrjan, M., Samiee, F., Soltani, M. and Hosseini Shekarabi, S. P. 2017. Impacts of extremely low-frequency electromagnetic fields (50-Hz) on growth performance and survival rate of common carp, *Cyprinus carpio* fingerlings. Caspian Journal of Environmental Sciences, 15(4):299-308.

Mohammadian, H. 1999. Freshwater Fishes of Iran. Sepehr Publications Center, Tehran. vii + 178 pp. In Farsi.

Mohammadian, T., Alishahi, M., Tabandeh, M. R., Ghorbanpoor, M. and Gharibi, D. 2017. Effect of *Lactobacillus plantarum* and *Lactobacillus delbrueckii* subsp. *bulgaricus* on growth performance, gut microbial flora and digestive enzymes activities in *Tor grypus* (Karaman, 1971). Iranian Journal of Fisheries Sciences, 16(1):296-317.

Mohammadian, T., Alishahi, M., Tabandeh, M. R., Ghorbanpoor, M., Gharibi, D., Tollabi, M. and Rohanizade, S. 2016. Probiotic effects of *Lactobacillus plantarum* and *L. delbrueckii* ssp. *bulguricus* (*sic*) on some immune-related parameters in *Barbus grypus*. Aquaculture International, 24(1):225-242.

Mohammadian, T., Ghanei-Motlagh, R., Molayemraftar, T., Mesbah, M., Zarea, M., Mohtashamipour, H. and Jangaran Nejad, A. 2021. Modulation of growth performance, gut microflora, non-specific immunity and gene expression of proinflammatory cytokines in shabout (*Tor grypus*) upon dietary prebiotic supplementation. Fish and Shellfish Immunology, 112:38.45.

Mohammadian, T., Ghaneimotlagh, R., Heidari, A. A., Masjoor, S. and Emam, M. 2020. Effect of dietary supplement of digetosterome on growth performance, antioxidant system and some liver enzymes of common carp, *Cyprinus carpio*. Journal of Aquaculture Sciences, 8(1):67-80. In Farsi.

Mohammadian, T., Jangaran-Nejad, A., Mesbah, M., Shirali, T., Malekpouri, P. and Tabandeh, M-R. 2020. Effect of *Lactobacillus casei* on innate immunity responses and *Aeromonas hydrophila* resistance in shabot, *Tor grypus*. Probiotics and Antimicrobial Proteins, 12(1):224-235.

Mohammadian, T., Kouchenin, P., Nikou, S., Sheykh Aleslami, M., Bita, S., Eskandari, Gh. R. and Abhari Seh Gonbad, H. 2009. Comparison of the effectiveness GnRHa hormone (ova-fact) and carp pituitary extract on reproduction indexes (*sic*) of *Barbus sharpeyi*. Iranian Veterinary Journal, 5(2)(23):70-80. In Farsi.

Mohammadian, T., Mashjoor, S., Ghanei-Motlagh, R. and Robatkarimi, H. K. 2020. Effect of diet administration of Myrtus essential oils (*Myrtus communis* L.) on biochemical and antioxidant parameters of common carp (*Cyprinus carpio*) blood serum. Journal of Aquaculture Development, 14(3):113-126. In Farsi.

Mohammadian, T., Mesbah, M., Khaj, H. and Sadeghi, K. 2017. Influence of immunogenic prebiotic on biochemical parameters of blood serum of SHIRBOT fish (*Tor grypus*).

Journal of Wetland Ecobiology, 9(2):27-38, 109. In Farsi.
Mohammadian, T., Mesbah, M., Rohanizade, S., Alishahi, M., Alizade, P. and Abdi, E. 2015. Studying the effect of Immunogen on microflora of intestine and carcass composition of *Barbus grypus*. Pajouhesh va Sazandegi, 28(1):2-9. In Farsi.
Mohammadian Kalat, T. and Shabanipour, N. 2010. Internal anatomy of common carp (*Cyprinus carpio*) as revealed by magnetic resonance imaging. Applied Magnetic Resonance, 38(3):361-369.
Mohammadian-kalat, T., Aliabadian, M. and Esmaeili, H. R. 2013. Biosystematics of *Alburnus* in Iran using morphologic and molecular methods. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 81 (abstract).
Mohammadian-kalat, T., Aliabadian, M. and Esmaeili, H. R. 2015. Morphological comparisons of *Alburnus atropatenae* Berg, 1926 populations in Urmia lake basin (Teleostei: Cyprinidae). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 173-174.
Mohammadian-kalat, T., Aliabadian, M. and Esmaeili, H. R. 2017. High molecular and morphological changes in *Alburnus mossulensis* Heckel, 1843 populations in Iran (Teleostei: Cyprinidae). Journal of Applied Ichthyological Research, 5(3):27-42. In Farsi.
Mohammadian-kalat, T., Aliabadian, M., Esmaeili, H. R., Abdolmalaki, S., Zamanian Nejhad, R. and Vatandoust, S. 2015. Species list and distribution map of the genus *Alburnus* Rafinesque, 1820 (Cyprinidae: Leuciscinae) in Iran. Check List, 11(5)(1743):5 pp.
Mohammadian-kalat, T., Aliabadian, M., Zamanian Nejhad, R., Vatandoust, S. and Esmaeili, H. R. 2014. Distribution pattern and distribution map of the genus *Alburnus* Rafinesque, 1820. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Mohammadian-kalat, T., Esmaeili, H. R., Alaiabadian, M. and Freyhof, J. 2017. Re-description of *Alburnus doriae*, with comments on the taxonomic status of *A. amirkabiri*, *A. mossulensis*, *A. sellal* and *Petroleuciscus esfahani* (Teleostei: Cyprinidae). Zootaxa, 4323(4):487-502.
Mohammadian-kalat, T. and Shabanipour, N. 2013. Efficiency of magnetic resonance imaging (MRI) in study of fish skeletal muscles. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 80 (abstract).
Mohammadimakvandi, Z., Kochanian, P. and Pashazanoosi, H. 2011. Effect of salinity on haematocrit and haemoglobin in fingerling silver carp (*Hypophthalmichthys molitrix*). Journal of Wetland Ecobiology, 2(7):11-17. In Farsi.
Mohammaditabar, B., Allahyari, M. S. and Behmanesh, S. 2019. Barriers of carp farming development in Rasht County. Journal of Aquaculture Development, 13(2):107-124. In Farsi.
Mohammadiyan, T., Alboshokeh, S. N., Mohammadiyan, A., Mesbah, M., Mohammadi, A. and Shirali, T. 2014. Annual variation of sex steroid hormones in female *Barbus sharpeyi*. Journal of Veterinary Research, 69(2):159-164. In Farsi.
Mohammadiyan, T., Alishahi, M., Tabande, M. R., Doos Ali, Z. and Jangaran Nejad, A. 2017. Effect of different levels of *Lactobacillus casei* on growth performance and digestive enzymes activity of shirbot (*Barbus grypus*). Journal of Veterinary Research, 72(1):43-52. In Farsi.
Mohammadiyan, T., Silavi, M., Hosseni, A., Hedari, B., Mesbah, M. and Bita, S. 2014. New method (biotechic) for artificial breeding of *Barbus sharpeyi*. Journal of Fisheries,

67(3):405-412, 7. In Farsi.
Mohammadiyan, T., Tabande, M. R. and Khaj, H. 2019. Comparison of tissue distribution of rhodanese enzyme in native species of Karoun River. Journal of Veterinary Research, 74(2):229-236. In Farsi.
Mohammadjafari, N. and Imanpoor, M. R. 2019. Investigating the possibility of removing egg adhesion by the alkaline (*sic*, alkalase), tannic acid and sodium chloride enzymes instead of carbamide solution in the artificial propagation process of common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(3):221-226. In Farsi.
Mohammadkhani, H. 2013. Ecological study on fisheries important rivers and bays in the south part of the Caspian Sea 2nd phase: Gorgan Bay. Iranian Fisheries Science Research Institute, Tehran. 97 pp. In Farsi.
Mohammadnejad Shamoushaki, M., Ebrahimi, Kh. and Farshadi, R. 2011. The effect of feeding frequency on some blood serum factors in the common carp (*Cyprinus carpio*). Journal of Animal Biology, 3(2):55-62. In Farsi.
Mohammadnejad Shamoushaki, M., Eslami, Z., Jabbari, E. and Mazini, M. 2012. Effect of rearing tank color on fish survival and growth factors on *Rutilus rutilus caspicus*. Journal of Fisheries, 6(2):77-84. In Farsi.
Mohammadnejad Shamoushaki, M. and Miraghazadeh, S. 2011. The effect of zeolite on growth factors and survival of *Cyprinus carpio*. Journal of Animal Biology, 4(1):69-74. In Farsi.
Mohammadnezhad Shamoushaki, M., Mohammad Sharifi, L., Salehi Vali, E. and Maleki, Sh. 2009. Determining of the lethal concentrations (LC50/96H) of the toxin endosulfan on the Caspian kutum (*Rutilus frisii kutum*, vobla (*Rutilus rutilus caspicus*) and common carp (*Cyprinus carpio*). Journal of Animal Biology, 1(4):51-58. In Farsi.
Mohammadnezhad Shamoushaki, M., Soltani, M., Sharifpour, R., Imanpour, M. R. and Baharlouei, A. 2012. Effect of organophosphate diazinon on some organs in *Rutilus frisii kutum*. Journal of Utilization and Cultivation of Aquatics, 1(2):83-96. In Farsi.
Mohammadrezaei, D. 2018. Identification of vitellogenin gene expression patterns in liver and ovary of *Rutilus frisii kutum* exposed to genistein and β-sitosterol. Iranian Scientific Fisheries Journal, 27(3):153-158. In Farsi.
Mohammadrezaei, D. 2020. Effect of spirulina and clove powder on growth performance and carcass composition in common carp fingerlings (*Cyprinus carpio*). Journal of Animal Environment, 12(2):189-194. In Farsi.
Mohammadrezaei, D., Mojazi Amiri, B. and Nematollahi, M. A. 2018. Effects of genistein and β-sitosterol on early life of Caspian kutum. Ecopersia, 6(3):163-169.
Mohammadsalehi, A., Askary Sary, A. and Velayatzadeh, M. 2014. Study of carp fish reared together with ducks. Breeding and Aquaculture Sciences Quarterly, 2(2):49-58. In Farsi.
Mohammadyari, A., Ghassemzadeh, F., Molavi, F., Mohammadzadeh, M. and Fooladi, A. 2015. First report of brine shrimp *Artemia* (Branchiopoda: Anostraca) from Bazangan Lake, Iran. Iranian Journal of Animal Biosystematics, 11(2):183-186.
Mohammadzadeh, P., Jamili, S., Mashinjeeyan, A., Mateinfar, A. and Rostami, M. 2011. A survey on accumulation effects of fish liver and gill tissues of *Rutilus rutilus caspius* (*sic*). Journal of Animal Environment, 3(1):59-68. In Farsi.
Mohammadzadeh, S., Falahatkar, B., Ouraji, H. and Noverian, H. 2012. Effect of carbohydrate levels on growth and digestive enzymes in Caspian kutum (*Rutilus frissi* (*sic*) *kutum*) fingerlings. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-

Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 421-425.
Mohammadzadeh, S., Hasantabar, F. and Abedi, Z. 2012. Growth performance of kutum (*Rutilus frisii kutum*) larvae in relation to feeding duration with live food and artificial dry feed. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 237-248.
Mohammadzadeh, S., Moradian, F., Yeganeh, S., Falahatkar, B. and Milla, S. 2020. Design, production and purification of a novel recombinant gonadotropin releasing hormone associated peptide as a spawning inducing agent for fish. Protein Expression and Purification, 166:105510.
Mohammadzadeh, S., Noverian, H. A., Ouraji, H. and Falahatkar, B. 2017. Growth, body composition and digestive enzyme responses of Caspian kutum, *Rutilus frisii* (Kamenskii, 1901), juveniles fed different levels of carbohydrates. Journal of Applied Ichthyology, 33(5):983-990.
Mohammadzadeh, S., Ouraji, H., Falahatkar, B. and Noverian, H. 2012. Effect of dietary carbohydrate levels on growth and survival in Caspian kutum. Aqua 2012, 1-5 September 2012, Prague (title).
Mohammadzadeh, S., Ouraji, H., Hasantabar, F. and Khalesi, M. K. 2014. Growth performance and thyroid hormones of Caspian kutum, *Rutilus frissi* (*sic*), juveniles in response to dietary carbohydrate levels. International Aquatic Research, 6(2):1-6.
Mohammadzadeh, S., Yeganeh, S., Moradian, F. and Rekabi, M. 2020. Study on biological performance of recombinant GnRH as a spawning-inducing agent for goldfish (*Carassius auratus*). Iranian Scientific Fisheries Journal, 29(2):21-31. In Farsi.
Mohammadzadeh Baran, S., Mashinchian Moradi, A., Sharifpour, I., Jamili, Sh. and Ghavam Mostafavi, P. 2018. The in vitro effect of methyl tert-butyl ether on liver, gills, and kidney tissues of *Rutilus caspicus*. Iranian Journal of Fisheries Sciences, 17(4):821-834.
Mohammadzadeh Baran, S., Mashinchian Moradi, A., Sharifpour, I., Jamili, Sh. and Ghavam Mostafavi, P. 2019a. The in vitro effect of methyl tert-butyl ether on DNA of blood cells (*Rutilus caspicus)* by Comet Assay. Journal of Animal Biology, 11(2):81-92. In Farsi.
Mohammadzadeh Baran, S., Mashinchian Moradi, A., Sharifpour, I., Jamili, Sh. and Ghavam Mostafavi, P. 2019b. Effect of methyl tert-butyl ether (MTBE) at in vitro conditions on antioxidant enzyme activities of superoxide dismutase and catalase in *Rutilus caspicus* (Yakovlev, 1870). Caspian Journal of Environmental Sciences, 17(1):55-62.
Mohammadzadeh Baran, S., Vousoughi, Gh. H., Mashinchian Moradi, A., Abbasi, F. and Ghavam Mostafavi, P. 2009. Study of $HgCl_2$ effects on muscle tissue in the Caspian roach (*Rutilus rutilus*) in vitro conditions. Journal of Animal Biology, 1(4):41-50. In Farsi.
Moharamifard, Z., Seyfabadi, J. and Rabbaniha, M. 2015. Spatial distribution and density of macrofauna in the southeast of the Caspian Sea and their importance in fish feeding. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 77.
Mohebbi, F., Riahi, H., Sheidaei, M. and Shariatmadari, Z. 2016. Phytoplankton of Aras dam reservoir (Iran): an attempt to assess water quality. Iranian Journal of Fisheries Sciences, 15(4):1318-1336.
Mohebbi Moghaddam, M., Baghshani, H. and Shahsavani, D. 2016. Effect of dietary β-carotene supplementation on some oxidative status biomarkers in common carp (*Cyprinus carpio*)

tissues. Journal of Aquaculture Development, 10(4):103-111. In Farsi.
Mohebi Derakhsh, P., Mashinchian Moradi, A., Sharifpour, I. and Jamili, Sh. 2019. The effect of Diclofenac diluted phase as a pollutant on the activity of catalase and superoxide dismuthase in *Cyprinus carpio*. Iranian Scientific Fisheries Journal, 27(6):25-34. In Farsi.
Mohebi Derakhsh, P., Mashinchian Moradi, A., Sharifpour, I. and Jamili, Sh. 2020. Toxic effects of diclofenac on gills, liver and kidney of *Cyprinus carpio* (Linnaeus, 1758). Iranian Journal of Fisheries Sciences, 19(2):735-747.
Mohiseni, M., Aghababaee, Z., Banaee, M. and Nematdoost Haghi, B. 2014. Evaluation on the effect of rose mallow extract (*Althaea officinalis*) on physiological tolerance of common carp (*Cyprinus carpio*) exposed to heavy metals. Journal of Utilization and Cultivation of Aquatics, 3(3):53-66. In Farsi.
Mohiseni, M., Amini Chermahini, M., Karimi, M. and Bagheri, D. 2018. Study on the effects of pectin, a feed additive against cadmium toxicity in common carp (*Cyprinus carpio*). Journal of Animal Environment, 10(4):309-316. In Farsi.
Mohiseni, M., Bagheri, D., Banaee, M. and Nematdust Haghi, B. 2017. Evaluation of oxidative stress induced by cadmium and comparative antioxidant effects of Shirazi thyme (*Zataria multiflora* Boiss) and vitamin E in common carp (*Cyprinus carpio*). International Journal of Aquatic Biology, 5(6):360-369.
Mohiseni, M., Banaee, M., Nematdust Haghi, B. and Vahid Farabi, S. M. 2016. Effects of feed deprivation on chloride cell development in kutum fish (*Rutilus frisii kutum*) during sea water challenges. Journal of Aquatic Ecology, Hormozgan University, 5(4):88-97. In Farsi.
Mohiseni, M., Farabi, S. M. V., Banaee, M. and Nematdust Haghi, B. 2016. Effects of fasting on body electrolytes in kutum fish (*Rutilus frisii kutum*) during sea water adaptation. Journal of Aquaculture Development, 10(4):111-124. In Farsi.
Mohiseni, M., Sadeghian, M., Nematdust Haghi, B. and Bagheri, D. 2019. Effects of dietary Shirazi thyme (*Zataria multiflora* Boiss) and vitamin E on growth and biochemical parameters in common carp (*Cyprinus carpio*). Iranian Journal of Fisheries Sciences, 18(3):517-530.
Mohiseni, M., Sepidnameh, M., Bagheri, D., Banaee, M. and Nematdust Haghi, B. 2018. Improvement in physiological potency of common carp fed with Shirazi thyme and vitamin E as complementary feed additives. Iranian Scientific Fisheries Journal, 26(5):167-171. In Farsi.
Mohsen-Zadeh, A. and Bahadori, Z. 2001. Investigation on age and growth of bleak *Chalcalburnus chalcoides*. B.Sc. Project, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan. 66 pp. In Farsi.
Mohseni, F., Banaee, M., Shokat, P. and Mohiseni, M. 2018. Effects of dimethoate and bacilar fertilizer on biochemical and immunological parameters in common carp, *Cyprinus carpio*. International Journal of Aquatic Biology, 6(5):254-257.
Mohseni, M., Mojazi Amiri, B., Mirvaghefi, A., Farabi, M. V. and Riazi, G. 2015. Study on the change of some ion, hormone and biochemical factors in released fingerling of kutum fish (*Rutilus frisii kutum* Kamensky, 1901) at the estuary of Tajan River (Sari). Journal of Fisheries, 68(1):139-155. In Farsi.
Mohseninejad, L. and Peyghan, R. 2016. Effect of feeding diet on bacterial count and histology of intestine in grass carp, *Ctenopharyngodon idella*. Journal of Animal Environment, 8(2):223-230. In Farsi.

Mohsenpour, R. and Shafiei Sabet, S. 2021. The potential effect of sound on the Iranian endemic fishes. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.

Mohzdeganlou, Z., Ebrahimzadeh Mousavi, H., Shayan, P., Soltani, M., Ebrahimzadeh, E. and Rostami, M. 2011. Detection of single *Dactylogyrus* spp. in DNA extracted from infected gill tissue of fishes using Polymerase Chain Reaction. Iranian Journal of Veterinary Medicine, 5(2):77-80.

Moini, S. and Basimy, B. 2004. Production of fish cake from carp and its shelf life in cold store at -18ºC. Iranian Scientific Fisheries Journal, 13(1):163-170. In Farsi.

Moini, S., Mouloodi, Z., Shabanpour, B. and Rahmanifarah, K. 2011. Effects of stunning by ice and clove oil, and asphyxia on stress responses and quality indicators in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 64(2):153-162. In Farsi.

Moini, S., Sobhanipour, N. and Moini, S. 2005. Production of fried marinade from roach (*Rutilus rutilus caspius*). Iranian Scientific Fisheries Journal, 14(1):133-146. In Farsi.

Moiseev, P. A. 1971. The living resources of the world ocean. Israel Program for Scientific Translations, Jerusalem. 334 pp.

Mojjabavi, H. R. 1994. Aquaculture needs and strategies. Abzeeyan, Tehran, 4(10):44-47. In Farsi.

Mojtahedzadeh, P. 2001. Hamoon Lake catastrophe, the most similar to Oral (*sic*) Lake catastrophe. Osveh, Teheran, 1:34-49. In Farsi (www.netiran.com/HtDocs/Clippings/Social/010130XXSO03.html).

Mojoudi, F., Hamidian, A. H. and Eagderi, S. 2018. Lethal concentrations (LC_{50}-96h) of $Pb(NO_3)_2$ in common carp, *Cyprinus carpio*. The 2nd International Congress of Fisheries and Aquatic Research, Neveshir, Turkey (abstract).

Mojoudi, N., Mojoudi, F. and Kafilzadeh, F. 2013. Investigate of accumulation the heavy metals Cd, Pb, and Zn in liver and muscle tissues *Capoeta trutta* fish from Dez River, southwest Iran. International Journal of Biosciences, 3(8):325-331.

Mokhayer, B. 1972. La piscicoltura in Iran. Rivista italiana di Piscicoltura e Ittiopatologia, 7(1):7-9.

Mokhayer, B. 1975. Study on the parasitic infection of fishes in river Sefid. Veterinary School Bulletin, Tehran, 4:36. In Farsi.

Mokhayer, B. 1976a. Treatment of bothriocephalosis in grass carp. Rivista italiana di Piscicoltura e Ittiopatologia, 11:119-121.

Mokhayer, B. 1976b. Fish diseases in Iran. Rivista italiana di Piscicoltura e Ittiopatologia, 11(4):123-128.

Mokhayer, B. 1981a. Parasites des poissons du bassin de Sefid-Roude. Journal of the Veterinary Faculty of the University of Tehran, 36(4):61-75. In Farsi.

Mokhayer, B. 1981b. Infection of Karoun River and Arvandroud mullet with Contracaecum larvae. Journal of the Veterinary Faculty of the University of Tehran, 37(1):91-102. In Farsi.

Mokhayer, B. 1985. Diseases of Cultivated Fishes. Tehran University Publications, Tehran. 318 pp. In Farsi.

Mokhayer, B. 1989. Fish Diplostomiasis in Iran. Journal of the Veterinary Faculty of the University of Tehran, 44(2):11-18.

Mokhayer, B. 2000. Parasitic helminths of Caspian roach (larval stage). The Third World Fisheries Congress, Beijing, 31 Oct - 3 Nov 2000 (title).
Mokhayer, B., Hassanzadeh Kiabi, B. and Kohestan Eskandari, S. 2000. Study of *Tracheliastes* and *Acanthocephalornoides* in khramulia of Golestan National Park River. Iranian Journal of Veterinary Research, Shiraz University, 2:65-66.
Mokhayer, B., Kiabi, B. and Kouhestan Eskandari, S. 2000. Investigation on the infection of khramulya (Capoeta capoeta gracilis) with Acantho-cephalorhynchoides and Tracheliastes. Journal of the Faculty of Veterinary Medicine University of Tehran, 55(2):65-66.
Mokhayer, B., Mesbah, M., Peyghan, R. and Jalali, B. 2006. Study of monogenetic trematodes infestation in benni, *Barbus sharpeyi* from Shadegan Marsh and mode of their attachment to gills. Iranian Veterinary Journal, 2(2)(13):48-57. In Farsi.
Mokhayer, B. and Setareh, J. 2000. Parasitic helminths of Caspian roach from southern Caspian Sea. The Third World Fisheries Congress, Beijing, 31 Oct - 3 Nov 2000 (title).
Molaee Ghasemi, N., Shabany, A. and Safari R. 2020. The effects of dietary administration of potassium sorbate on growth related genes expression in common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(4):223-228. In Farsi.
Molayemraftar, T., Peyghan, R., Razi Jalali, M. and Shahriari, A. 2018. Interactive effect of treatment with copper sulfate and formalin bath with nitrite and ammonia intoxication, on some biochemical parameters of blood serum of common carp. Iranian Veterinary Journal, 14(1):70-80, 115. In Farsi.
Mollazadeh, M. and Mirsajjadi, M. 2016. Accumulation of zinc and cadmium in the liver and muscle of black fish of Sardab-Rood freshwater and its effect on human health**.** Journal of Wetland Ecobiology, 8(3):27-34. In Farsi.
Molle, F., Ghazi, I. and Murray-Rust, H. 2009. Buying respite: Esfahan and the Zayandeh Rud River basin, Iran, pp. 196-213. In: Molle, F. and Wester, P. (Eds.). River Basin Trajectories; Societies, Environments and Development. C.A.B. International, Wallingford. xiv + 311 pp.
Molnár, K. and Baska, F. 1993. Scientific report on intensive training course on parasites and parasitic diseases of freshwater fishes of Iran, 15-25 November 1993, Fisheries Company of Iran. 15 pp.
Molnár, K. and Jalali, B. 1992. Further monogeneans from Iranian freshwater fishes. Acta Veterinaria Hungarica, 40(1-2):55-61.
Molnar, K. and Jalali, B. 1993. Occurrence of monogeneans on common carp of Iran and description of pathogenicity of *D. sahuensis* (Ling 1965) in infected common carp. In: Symposium on the Carp, Budapest, Hungary, 6-9 September 1993 (abstract).
Molnár, K., Masoumian, M. and Abasi, S. 1996. Four new *Myxobolus* spp. (Myxosporea: Myxobolidae) from Iranian barboid fishes. Archiv für Protistenkunde, 147(1):115-123.
Molnár, K. and Pazooki, J. 1995. Occurrence of philometrid nematodes in barboid fishes of River Karun, Iran. Parasitologia hungarica, 28(10):57-62.
Momtazan, M, Asefi, M. and Zamani Ahmadmahmoud, R. 2016. Comparison between age, length and weight with mercury concentration in the muscle of two fish species, *Barbus grypus* and *Barbus luteus* of fishes Maroon River in Behbahan. Journal of Water and Wastewater, 27(2):54-60. In Farsi.
Monajjemi, M., Ghorbani, R., Vesaghi, M. J. and Norooz Rajabi, A. R. 2014. Age structure, growth and mortality index of spirlin (*Alburnoides eichwaldii* De Filippi 1863) in Shirud

River, Mazandaran Province. Journal of Fisheries Science and Technology, 2(4):57-67. In Farsi.

Monavari, S. M. and Mardani, N. 2007. Environmental effects of fish culture ponds on Jajrood River, Tehran Province. Iranian Scientific Fisheries Journal, 16(1):169-176. In Farsi.

Monawari, S. M. 1990. Ecological situation of the Anzali Marsh. Gilkan 8, Ecology 1, Rasht. 227 pp. In Farsi.

Monajjemi, M. 2015. Effects of temperature and feeding frequency on growth, juveniles Caspian roach (*Rutilus rutilus caspicus*). Journal of Utilization and Cultivation of Aquatics, 4(3):51-61. In Farsi.

Monsefrad, F., Imanpour Namin, J. and Heidary, S. 2012. Concentration of heavy and toxic metals Cu, Zn, Cd, Pb and Hg in liver and muscles of *Rutilus frisii kutum* during spawning season with respect to growth parameters. Iranian Journal of Fisheries Sciences, 11(4):825-839.

Monsefrad, S. F., Imanpour Namin, J., Heidary, S., Mohammadi, M. and Hosseini, S. M. 2012. Interaction of essential and nonessential metals in tissues of *Rutilus frisii kutum* from southwestern basins of the Caspian Sea. Journal of Fisheries (Iranian Journal of Natural Resources), 65(1):79-87. In Farsi.

Mood, S. M., Ebrahimzadeh Mousavi, H. A., Mokhayer, B., Ahmadi, M., Soltani, M. and Sharifpour, I. 2010. *Centrocestus formosanus* metacercarial infection of four ornamental fish species imported into Iran. Bulletin of the European Association of Fish Pathologists, 30(4):146-149.

Mooraki, N., Akhavan Sepahi, A. and Mazhar Seyedeh, F. 2014. In vitro testing inhibitory effect of *Staphylococcus equorum* on growth of *Aeromonas dhakensis* strain isolated from Caspian Sea bream (*Abramis brama orientalis*) intestine. Journal of Marine Biology, 6(2):9-24. In Farsi.

Mooraki, N. and Dadgar, Sh. 2015. The effect of using parsley (Petroselinum sativum) on growth performance of koi fish (Cyprinus carpio). Middle East Aquaculture Forum, Dubai International Convention and Exhibition Center, Dubai, United Arab Emirates, 5-6 April 2015 (abstract).

Mooraki, N., Dadgar, Sh. and Sadegh Naderi, M. 2014. The effect of using parsley (*Petroselinum sativum*) on growth performance of koi fish (*Cyprinus carpio*). Journal of Aquaculture Development, 8(2):63-72. In Farsi.

Moore, M. J., Mitrofanov, I. V., Valentini, S. S., Volkov, V. V., Kurbskiy, A. V., Zhimbey, E. N., Eglinton, L. B. and Stegeman, J. J. 2003. Cytochrome P4501A expression, chemical contaminants and histopathology in roach, goby and sturgeon and chemical contaminants in sediments from the Caspian Sea, Lake Balkhash and the Ily River Delta, Kazakhstan. Marine Pollution Bulletin, 46(1):107-119.

Moori Bakhtiari, N., Peyghan, R. and Monzavi, F. 2017. Determination of isolated *Aeromonas hydrophila* antibiotic resistance profile from farmed common carp (*Cyprinus carpio*) in Khuzestan Province. Iranian Scientific Fisheries Journal, 25(5):41-50. In Farsi.

Moori Bakhtiari, N., Tulaby Dezfuly, Z. and Alishahi, M. 2017a. Determination of antimicrobial resistance profile in *Aeromonas hydrophila* isolates in common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 153-157. In Farsi.

Moori Bakhtiari, N., Tulaby Dezfuly, Z. and Alishahi, M. 2017b. Evaluation of biofilm formation ability in different isolates of *Aeromonas hydrophila*. The Fifth Iranian

Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 203-206. In Farsi.

Moosavi, M., Nasri, M. and Eagderi, S. 2014. Phenotype plasticity of bigmouth lotak, *Cyprinion macrostomum* Heckel, 1843 from Tigris basin using geometric morphometrics method. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Moosavi, S. A. and Masoomi Zadeh, S. Z. 2015. Similarities and differences in artificial breeding between *Mesopotamichthys sharpeyi* and *Arabibarbus grypus*. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 154.

Moosavian, M. and Dashti, A. 2011. Isolation and identification of legionellosis agents from fishponds, swimming pools and cooling towers in Khuzestan province, Iran. Jundishapur Journal of Microbiology, 4(4):209-215.

Moradi, M. and Eagderi, S. 2014. First record of the lake goby *Rhinogobius similis* Gill, 1859 from the Urmia Lake basin, Iran. Biyoloji Bilimleri Araştırma Dergisi, 7(2):52-55.

Moradi, M., Sadatipour, S. M. T., Sharifloo, N. M. and Zaeimdar, M. 2010. An investigation on environmental impact of Polrud Dam and providing strategies reducing environmental impacts. Journal of Marine Science and Technology Research, 5(2):23-32. In Farsi.

Moradi, Y., Khanipoor, A. A. and Lakzaie, F. 2017. Study of the amount of benzo [a] anthracene in muscle of five species fish in Anzali Wetland. Journal of Aquaculture Development, 11(1):119-125. In Farsi.

Moradi, Z. 2008. The collaboration and contrast of science and art in miniatures of the book of Qazwini. M.A. Thesis, Alzahra University, Tehran. In Farsi.

Moradi, Z. 2017. Fish as a marvelous creature in myths and manuscripts: An overview. Iranian Journal of Ichthyology, 4(3):188-219.

Moradi, Z. and Esmaeili, H. R. 2015. Studying of Iranian fish fauna by fish imagery in Iranian artwork. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 55.

Moradian, F., Jamili, Sh., Bahmani, M., Toloei, M. H. and Mohammadi, Gh. 2003. The effect of thyroxine on percentage of hatching *(Hypophthalmichthys molitrix*). Iranian Scientific Fisheries Journal, 12(3):167-174. In Farsi.

Moradi Chafi, M. 2009. Study of some biological characteristics of khramulia in the Ghazal Ozan River. M.Sc. Thesis, Islamic Azad University of Lahijan, Iran.

Moradi Chafi, M., Abbasi, K., Bagheri, S., Sayadrahim, M., Sabkara, J., Makaremi, M. and Khatib, S. 2016. Study of *Hemiculter leucisculus* diet in Chitgar Lake, Tehran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Moradi Chafi, M., Abbasi, K., Valipour, A., Abedini, A., Sabkara, J. and Nikpour, M. 2017. Studying natural reproduction status of kutum, *Rutilus frisii* in Khaleh-Sara and Khoshkrud Rivers at Guilan province in 2016. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Moradi Chafi, M., Abbasi, K., Valipour, A., Pourgholami Moghadam, A. and Abedini. A. 2016. Studying natural reproductive status of kutum, *Rutilus frisii* in Khaleh-Sara and Khoshkrud rivers in Guilan province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Moradi Chafi, M., Khodaparast, H., Abbasi, K., Sabkara, J., Makaremi, M., Khatib, S. and

Sayadrahim, M. 2016. Study of *Carassius gibelio* diet in Neor Lake, Ardebil Province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

MoradiChafi, M., Abbasi, K., Bagheri, S., Sayadrahim, M., Sabkara, J., Makaremi, M., Khatib, S., Zahmatkesh, Y. and Nikpour, M. 2017. Study of *Alburnus hohenackeri* diet in the Chitgar Lake, Tehran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

MoradiChafi, M., Abbasi, K., Bagheri, S., Sayadrahim, M., Sabkara, J., Makaremi, M., Khatib, S., Zahmatkesh, Y., Nikpour, M. and Madadi, F. 2017. Study of *Hypophthalmichthys molitrix* diet in the Chitgar Lake, Tehran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

MoradiChafi, M., Abbasi, K., Bagheri, S., Sayadrahim, M., Sabkara, J., Makaremi, M., Khatib, S., Zahmatkesh, Y., Nikpour, M. and Madadi, F. 2018. Study of *Cyprinus carpio* diet in Chitgar Lake, Tehran. The 6^{th} Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

MoradiChafi, M., Abbasi, K., Nikpour, M., Zahmatkesh, Y., Pourgholamimoghadm, A., Mahisefat, F. and Mohammadi Dust, R. 2018. Study of fecundity in *Scardinius erythrophthalmus* in Anzali Wetland. The 6^{th} Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

MoradiChafi, M., Abbasi, K., Nikpour, M., Zahmatkesh, Y., Sayadrahim, M., Mahisefat, F. and Dejhandian, S. 2018. Study of main reproductive characteristics of *Carassius gibelio* in Anzali Wetland. The 6^{th} Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Moradinasab, A., Ahmadi Fackjour, H., Kamrani, E., Sattari, M., Ghasemi, A., Tavakoli, M. and Haghparast, S. 2017. Study on age, growth and sex ratio of tench *Tinca tinca* (Linnaeus, 1758) in Anzali wetland. Journal of Fisheries Science and Technology, 6(1):119-126. In Farsi.

Moradinasab, A., Babaei, N., Parsa, M., Raeisi, H., Daliri, M., Rahnama, B., Nekuro, A. and Vesaghi, M. J. 2015. By-catch composition of kilka fishes (*Clupeonella*) lantern net in the southwest of the Caspian Sea (Bandar Anzali fishing grounds). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015 (abstract).

Moradinasab, A., Bahmani, M., Yousefi Jourdehi, A., Tavakoli, M., Behrouz Khoshghalb, M., Fanati Rashidi, F. and Sharifinia, M. 2015. Some biological characteristics of sea carp brood stock of *Cyprinus carpio* L. 1758 in the south of the Caspian Sea (Guilan province). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 118.

Moradinasab, A. A., Ghorbani, R., Paighambari, S. Y., Mehdipour, N. and Molaei, M. 2013. Study on some biological characteristic of rudd (*Scardinius erythrophthalmus* Linnaeus, 1758) in Anzali Wetland. Journal of Utilization and Cultivation of Aquatics, 1(4):29-44. In Farsi.

Moradinasab, Gh., Daliri, M., Ghorbani, R., Paighambari, S. Y. and Davoodi, R. 2012. Length-weight and length-length relationships, relative condition factor and Fulton's condition factor of five cyprinid species in Anzali wetland, southwest of the Caspian Sea. Caspian Journal of Environmental Sciences, 10(1):25-31.

Moradinasab, Gh., Ghorbani, R., Paighambari, S. B. and Khanipour, A. A. 2012. Assessment of efficiency between fyke net with fixed gill net in Anzali Wetland. Iranian Scientific

Fisheries Journal, 21(1):161-170. In Farsi.
Moradinasab, Gh., Paighambari, S. Y., Ghorbani, R. and Khanipour, A. A. 2012. Determination of catch composition and length frequency of caught teleostei fish by fixed gill net in Anzali wetland. The Second National Conference on Fisheries Sciences and Aquatic Organisms, Iran-Lahijan, May 10-12, 2012, pp. 31-38. In Farsi.
Moradinasab, Gh., Raeisi, H., Paighambari, S. Y., Ghorbani, R. and Bibak, Z. 2012. Length-weight relationships, relative condition factor and relative weight of three fish species from beach seine fishing grounds in Iranian coastal waters of Caspian Sea. Scientific Research and Essays, 7(18):1809-1812.
Moradi Sogholmechi, M., Hedayati, S. A. A., Hosseinifar, S. H. and Bagheri, D. 2018. The efficiency of probiotic *Lactobacillus* for improving the liver biochemical indices of common carp (*Cyprinus carpio*) exposed to sub-lethal levels of nano silver. Journal of Utilization and Cultivation of Aquatics, 7(3):53-61. In Farsi.
Moradpour DerazKolaei, A., Haghparast, S., Rahmani, H. and Aghaei Moghadam, A. 2021. Determination of habitat suitability index and the most significant factors on distribution pattern of *Capoeta capoeta* in Roodbabol river, Mazandaran Province. Journal of Applied Ichthyological Research, 8(4):1-14. In Farsi.
Moravec, F. and Amin, A. 1978. Some helminth parasites, excluding Monogenea, from fishes of Afghanistan. Acta Scientiarum Naturalium Academiae Scientiarum Bohemoslovace, Brno, 12(6):1-45.
Morid, R., Delavar, M., Eagderi, S. and Kumar, L. 2016. Assessment of climate change impacts on river hydrology and habitat suitability of *Oxynoemacheilus bergianus*. Case study: Kordan River, Iran. Hydrobiologia, 771(1):83-100.
Morid, S. 2012. Drought risk management plan for Lake Urmia Basin. Summary report. Working Group on Sustainable Management of Water Resources and Agriculture, Regional Council of Lake Urmia Basin Management, Iran. 29 pp.
Morier, J. 1818. A Second Journey through Persia, Armenia, and Asia Minor, to Constantinople, between the Years 1810 and 1816…. Longman, London. xix + 435 pp.
Morovvati, H., Abdi, R. and Shamsi, M. M. 2017a. Effect of different salinity concentration on gill of benni *Barbus sharpeyi*. Journal of Veterinary Research, 72(2):243-249. In Farsi.
Morovvati, H., Abdi, R. and Shamsi, M. M. 2017b. Effect of different salinity concentration on kidney of benni, *Barbus sharpeyi*. Iranian Scientific Fisheries Journal, 25(5):159-163. In Farsi.
Morovvati, H. and Alboghobeish, N. 2006. Seasonal changes of grass carp (*Ctenopharingodon* (*sic*) *idella*) lymphoid organs. XXVI Congress of the European Association of Veterinary Anatomists, 19-22 July 2006, Messina, Italy (title).
Morovvati, H., Alboghobeish, N., Noori, A. and Rasekh, A. 2006. Seasonal changes of pronephros lymphoid tissue in grass carp (*Ctenopharingodon* (*sic*) *idella*): a histometrical and histological study. Iranian Journal of Veterinary Research, Shiraz University, 7(3)(16):42-49.
Morovvati, H., Erfani Majd, N., Peyghan, R. and Mobaraki, Gh. 2011. Histological study of excretory portion of kidney in grass carp (*Ctenopharyngodon idella*). Scientific-Research Iranian Veterinary Journal, 6(4)(29):(abstract).
Morovvati, H., Fallah, S., Mesbah, M., Siavash Haghighi, Z. M. and Arefi, A. 2019. Compare histologic and histometric silver carp gills of immature and mature. Journal of Veterinary Research, 73(4):507-514. In Farsi.

Morovvati, H., Hadi Jafari, M., Khaksar, M. and Mesbah, M. 2015. Histological and histomorphometrical study of intestine in shirbot (*Barbus grypus*). Journal of Animal Biology, 8(1):53-61. In Farsi.

Morovvati, H., Khaksary Mahabady, M., Mesbah, M. and Fakoori, R. 2017. Anatomical and histological study of kidney in *Barbus grypus*. Journal of Marine Sciences and Technology, 16(2):49-61. In Farsi.

Morovvati, H., Khaksary Mahabady, M., Mesbah, M. and Hadi Jafari, M. 2018. Histological and histomorphometrical study of intestinal bulb in shirbot, *Barbus grypus*. Journal of Marine Sciences and Technology, 16(4):45-55. In Farsi.

Morovvati, H., Mahabady, M. K. and Shahbaz, S. 2012. Histomorphological and anatomical study of kidney in berzem (*Barbus pectoralis*). International Journal of Fisheries and Aquaculture, 4(11):221-227.

Morovvati, H., Mesbah, M., Shamsi, M. M., Rezaie, A. and Rashidi, Kh. 2017. Effect of different salinity concentration on different areas of the body skin of benni (*Barbus sharpeyi*). Journal of Marine Sciences and Technology, 16(3):89-101. In Farsi.

Morris, M. E. 1992. Poisoned wells: the politics of water in the Middle East. Middle East Insight, 8(2):35-39.

Morshedi, F. and Daneshvar, S. 2007. Renovation and rehabilitation of ancient Bahman weir in Fars, Iran. International History Seminar on Irrigation and Drainage, 2-5 May 2007, Tehran, pp. 305-310.

Morshedi, H., Norouzi, M. and Ghodrati, Sh. 2015. Nutritional value of common carp (*Cyprinus carpio* Linnaeus 1758) in the ripeness and sexual rest stages in two areas Behshahr and Anzali Wetland. Journal of Aquaculture Development, 9(1):81-91. In Farsi.

Mortazavi, A., Hatamikia, M., Bahmani, M. and Hassanzadazar, H. 2016. Heavy metals (mercury, lead and cadmium) determination in 17 species of fish marketed in Khorramabad City, west of Iran. Journal of Chemical Health Risks, 6(1):41-48.

Mortazavi, M., Ranaei, H. and Abbasi, H. 2011. The application of Multi Attribute Decision Methods (MADM) on prioritizing Iranian fisheries research projects. Iranian Journal of Fisheries Sciences, 10(1):47-66.

Mortazavi, S., Attaeian, B. and Abdolkarimi, S. 2016. Risk assessment and environmental geochemistry of Pb, Cu and Fe in surface sediments (case study: Hashilan Wetland, Kermanshah, Iran). Ecopersia, 4(2):1413-1426.

Mortazavi, S., Bakhtiari, A. R., Sari, A. E., Bahramifar, N. and Rahbarizade, F. 2012. Phenolic endocrine disrupting chemicals (EDCs) in Anzali Wetland, Iran: elevated concentrations of 4-nonylphenol, octhylphenol and bisphenol A. Marine Pollution Bulletin, 64(5):1067-1073.

Mortazavi, S. and Hatami Manesh, M. 2019. Accumulation and health risk assessment of heavy metals in *Ctenopharyngodon idella* and *Cyprinus carpio* from Bashar River, Yasouj. Journal of Aquatic Ecology, Hormozgan University, 9(3):1-13. In Farsi.

Mortazavi, S. and Norozi Fard, P. 2019. Investigation of metals bioaccumulation in sediment and fish muscle of Dez River in 1393. Journal of Environmental Science and Technology, 21(6):179-196. In Farsi.

Mortazavi, S., Riyahi Bakhtiari, A., Esmaili Sari, A., Bahramifar, N. and Rahbarizadeh, F. 2013. Occurrence of endocrine disruption chemicals (bisphenol A, 4-nonylphenol, and octylphenol) in muscle and liver of, Cyprinus *carpino common* (*sic*), from Anzali Wetland, Iran. Bulletin of Environmental Contamination and Toxicology, 90(5):578-584.

Mortazavi, S., Riyahi Bakhtiari, A. R., Esmaili Sari, A., Rahbarizadeh, F. and Hassanzadeh, N. 2019. Effects of xenostrogen treatment (4-nonylphenol, bisphenol A) on vitellogenin expression in juvenile *Cyprinus carpio*. Caspian Journal of Environmental Sciences, 17(1):43-53.

Mortazavi Tabrizi, J., Pazooki, J. and Javanmard, A. 2005. Infection of the fishes with *Ligula intestinalis* and *Bothriocephalus acheilognathi* in Sattarkhan Dam, northwestern Iran. Iranian Scientific Fisheries Journal, 13(4):161-168. In Farsi.

Mortazavizadeh, S. M., Amiri, F., Younesazadehfashlami, M., Hoseinzadeh Sahafi, H. and Hoshmand, H. 2013. The comparison of replacement ratio on Indian major carp with conventional carps in earthen pond in climatic condition of Khuzestan province. Iranian Scientific Fisheries Journal, 22(1):117-128. In Farsi.

Mortezaei, S., Mobedi, I. and Farahnak, A. 2000. Infection of some species of fresh water fishes to parasitic worms in Khouzestan Province, Iran. Iranian Scientific Fisheries Journal, 9(1):25-36, 4. In Farsi.

Mortezaei, S. R. S., Alishahi, M., Seifi, M. R. and Quasemi, M. 2014. Comparison of four RNA isolating methods for identification of spring viraemia of carp virus (SVCV). Iranian Scientific Fisheries Journal, 22(4):51-60. In Farsi.

Mortezaei, S. R. S., Pazooki, J. and Masoumian, M. 2007. Nematodes from freshwater fishes of Khuzestan Province. Pajouhesh va Sazandegi, 77:2-10. In Farsi.

Mortezavi Zadeh, S. A., Yooneszadeh Feshalami, M., Hosseinzadeh Sehafi, H., Amiri, F. and Makvandi, Gh. 2012. Impact of temperature on growth rate and survival of Indian fry carp (*Catla catla*), rohu (*Labeo rohita*) and mrigal (*Cirrhinus reba*) in cultured ponds condition in Khozestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 5(4)(20):61-70. In Farsi.

Mortezavizadeh, S. A. 2013. Feasibility study on semi intensive polyculture of chainess (*sic*) and Indian carps in I.R.IRAN (Khozestan province). Iranian Fisheries Science Research Institute, Tehran. 75 pp. In Farsi.

Mortezavizadeh, S. A., Hashemi, S. A. and Eskandary, G. R. 2010. Some aspects of reproductive biology of *Barbus barbulus* Heckel, 1847, from Karoon river, Iran. Iraqi Journal of Aquaculture, 7(2):123-136.

Mortezavizadeh, S. A., Moazedi, J. and Jorfi, E. 2009. The first attempt to artificial propagation of gattan (*Barbus xanthopterus*) by hypophysis extraction. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 51 (abstract).

Mortezavizadeh, S. A., Moazedi, J., Yooneszadeh Feshalami, M. and Jorfi, E. 2011. Determination of artificial propagation biotechnic of *Barbus xanthopterus*. Iranian Scientific Fisheries Journal, 19(4):137-142. In Farsi.

Mortezazadeh, S. A., Payghan, R. and Jalaly, E. R. 2009. Study on effect of the use of propofol anesthesia on some biochemical factors of blood serum of benni (*Barbus sharpeyi*). The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 72 (abstract).

Mosavi Dehmordi, L., Shoukat, P., Banaee, M. and Nematdoust Haghi, B. 2017. Limnological investigation and biological assessment of Maroon River. Journal of Animal Environment, 9(2):259-266. In Farsi.

Moshaiedi, F., Eagderi, S. and Hasanpour, S. 2014. Study of phenotypic variation in four populations of Urmia kingfish (*Alburnus atropatenae*) in Urmia Lake basin using Elliptic Fourier Analysis. Journal of Wetland Ecobiology, 6(2):35-43. In Farsi.

Moshaverinia, A., Jadidoleslami, A. and Aminzadeh Gowhari, M. 2016. *Argulus* spp. infestation in ornamental fishes in Mashhad, Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Moshayedi, F. 2016. Growth pattern and ontogeny of digestive system in the common carp (*Cyprinus carpio*) (var. sazan) during larval development. M.Sc. Thesis, University of Tehran, Tehran. In Farsi.

Moshayedi, F., Eagderi, S. and Iri, M. 2016. Body shape change in common carp, *Cyprinus carpio* var. sazan (Teleostei: Cyprinidae), during early development using geometric morphometric method. Iranian Journal of Ichthyology, 3(3):210-217.

Moshayedi, F., Eagderi, S. and Iri, M. 2017. Histological study of digestive system of common carp, *Cyprinus carpio* var. Sazan during early development stages. Journal of Fisheries (Iranian Journal of Natural Resources), 70(1):95-105. In Farsi.

Moshfegh, A., Setorki, M., Bahrpeyma, V., Tehranifard, A. and Rahimibashar, M. 2018. Hematology and plasma chemistry reference intervals for wild population of *Alburnus chalcoides* (Guldenstadt, 1772): Influence of sex, habitat and seasonal variation. International Journal of Aquatic Biology, 6(3):162-169.

Moshkani, M. and Pourkasmani, M. 2004. Identification of fishes in qanats of Birjand. Iranian Scientific Fisheries Journal, 12(4):163-172, 17. In Farsi.

Moslemi, M., Osko, N., Abedi, R. and Hosseini, S. V. 2018. Evaluation of *Origanum vulgare*'s extract on the fillet quality of modified atmosphere packaged grass carp during refrigerated storage. Journal of Fisheries (Iranian Journal of Natural Resources), 71(3):264-273. In Farsi.

Moslemi, M., Rahimi, M., Abedi, R. and Hosseini, S. V. 2019. Investigating on the marketing of fishery products by prioritizing factors affecting fish consumers: A case study in Babolsar. Journal of Aquaculture Sciences, 7(1):89-95. In Farsi.

Moslemi Ajarestaghi, A., Moslemi, M., Eagderi, S., Hosseini, S. V. and Abedi, R. 2018. Effects of slaughtering methods on quality of silver carp (*Hypophthalmichthys molitrix*) during refrigerated storage. Journal of Fisheries (Iranian Journal of Natural Resources), 70(4):416-423. In Farsi.

Mostafavi, H. 1998. Investigation and distribution of fish species in Talar River, Mazandaran, Iran. Seminar, Agricultural Sciences and Natural Resources University, Gorgan. 85 pp. In Farsi.

Mostafavi, H. 2007. Fish biodiversity in Talar River, Mazandaran Province. Journal of Environmental Studies, 32(40):127-135. In Farsi.

Mostafavi, H. and Abdoli, A. 2003. A study of fish species diversity in Talar River in Mazandaran. Environmental Sciences, 1(1):20-29. In Farsi.

Mostafavi, H. and Abdoli, A. 2005. A preliminary survey on diet of *Capoeta capoeta gracilis* in Talar and Yasalegh rivers from the southern basin of Caspian Sea. Environmental Sciences, 2(7):53-62.

Mostafavi, H. and Abdoli, A. 2006. Fish species diversity, distribution and abundance in Kesseliian Stream, Mazandaran, Iran. Journal of Environmental Sciences, 12(6): 25-32.

Mostafavi, H., Coad, B. W., Esmaeili, H. R., Mahini, A.S., Melcher, A., Pletterbauer, F., Schinegger, R., Teimori, A., Trautwein, C., Vatandoust, S. and Schmutz, S. 2012. A probabilistic model characterizing fish assemblages in running waters of Iran: a framework for environmental assessment. XIV European Congress of Ichthyology, University of Liège, Belgium, 3-8 July, 2012, p. 151 (abstract).

Mostafavi, H. and Ghafarikhah, B. 2021. Landscape assessment of rivers in the southern Caspian Sea basin in order to protect biodiversity. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Mostafavi, H. and Kambouzia, J. 2019. Modelling potential distribution of fluvial fish species for expanding conservation knowledge: Case study of the genus *Barbus* in Iran. International Journal of Aquatic Biology, 7(3):132-139.

Mostafavi, H., Pletterbauer, F., Coad, B. W., Mahini, A. S., Schinegger, R., Unfer, G., Trautwein, C. and Schmutz, S. 2014. Predicting presence and absence of trout (*Salmo trutta*) in Iran. Limnologica, 46:1-8.

Mostafavi, H., Rashidian Doliskani, M. and Valavi, R. 2018. Modelling the effects of climate change on the distribution of Kura bleak (*Alburnus filippii* Kessler, 1877) on the Iranian scale. Journal of Applied Ichthyological Research, 6(4):1-12. In Farsi.

Mostafavi, H., Schinegger, R., Melcher, A., Moder, K., Mielach, C. and Schmutz, S. 2015. A new fish-based multi-metric assessment index for cyprinid streams in the Iranian Caspian Sea Basin. Limnologica, 51:37-52.

Mostafavi, H., Schinegger, R., Pinter, K., Kremser, H., Bakhtiyari, M., Abdoli, A., Esmaeili, H. R., Teimori, A., Vatandost, S. and Schumtz, S. 2015. Comparison of human pressures and fish assemblages in the salmonid and cyprinid streams of the southern Caspian Sea basin. Iranian Journal of Ichthyology, 2(1):20-34.

Mostafavi, H. and Teimori, A. 2018. Investigating multiple human pressure types in the southern Caspian Sea basin rivers at different spatial scales towards Integrating Water Resource Management (IWRM) in Iran. Anthropogenic Pollution Journal, 2(1):38-47.

Mostafavi, H., Teimori, A., Schinegger, R. and Schmutz, S. 2019. A new fish-based multi-metric assessment index for cold-water streams of the southern Caspian Sea Basin in Iran. Environmental Biology of Fishes, 102(4):645-662.

Motafeghi, F., Javadi, I. and Allameh, S. K. 2018. Investigation of malachite green existence in rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*) flesh in the area of north and south of Iran, Haraz and Shar-e Kord. Iranian Scientific Fisheries Journal, 27(1):131-137. In Farsi.

Motallebi, Y. and Asadi, H. 2014. A review of the Iranian halal fishes (with emphasis on religious and scientific topics). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Motallebi, Y., Ojagh, M., Motallebi, A. A. and Safari, R. 2017. The effects of chitosan coating combined with natamycin on quality of salted kutum (*Rutilus frisii kutum*) roe during refrigerated storage. Iranian Scientific Fisheries Journal, 25(4):109-120. In Farsi.

Motamed, M. K. 2016. Investigating the attitudes and factors affecting fishermen's participation in cooperative corporations of Guilan Province. Co-operation and Agriculture (Taavon), 5(19):55-85. In Farsi.

Motamed, M. K., Abedi Prijaei, A. and Aminian, B. 2017. The role of extension training courses to adoption of integrated rice-fish culture in Guilan Province. Journal of Aquaculture Development, 11(3):95-109. In Farsi.

Motamedi, M. 2010. Taxonomy of *Barbus lacerta* complex within Iranian drainage systems: evidence by morphological and molecular data. M.Sc. Thesis, Shahid-Bahonar University of Kerman.

Motamedi, M., Madjdzadeh, S. M., Teimori, A. and Esmaeili, H. R. 2011. Systematic and

biogeography of the *Barbus lacerta* complex (Pisces: Cyprinidae) from Iran - inferred by molecular and morphological evidence, Biosystematics Berlin 2011, 21-27 February 2011 (abstract)

Motamedi, M., Madjdzadeh, S. M., Teimori, A., Esmaeili, H. R. and Mohsenzadeh, S. 2014. Morphological and molecular perspective on geographical differentiation of *Barbus* populations (Actinopterygii: Cyprinidae) within Iranian freshwater drainages. Turkish Journal of Fisheries and Aquatic Sciences, 14(2):339-351.

Mouloudi Saleh, A., Eagderi, S. and Nik Mehr, N. 2018. Geometric morphometric study of *Squalius turcicus* (De Filippi, 1865) in the Caspian rivers using principal components analysis. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Mouludi Saleh, A. and Keivany, Y. 2019. Comparison of Transcaucasian chub (*Squalius turcicus* De Filippi, 1865) populations in southwestern Caspian Sea basin using geometric morphometric method. Journal of Animal Researches (Iranian Journal of Biology), 32(3):197-205. In Farsi.

Mouludi Saleh, A., Keivany, Y. and Jalali, S. A. H. 2017. Geometric morphometric comparison of Namak chub (*Squalius namak*, Khaefi et al., 2016) in rivers of Lake Namak basin of Iran. Research in Zoology, 7(1):1-6.

Mouludi Saleh, A., Keivany, Y. and Jalali, S. A. H. 2018. Biometry of chub (*Squalius namak* Khaefi *et al*., 2016) in rivers of Namak Basin. Journal of Experimental Animal Biology, 7(1):107-118. In Farsi.

Mouludi Saleh, A. Keivany, Y., Jalali, S. A. H. and Zamani, M. 2018. Morphological flexibility of Transcaucasian chub (*Squalius turcicus* De Filippi, 1865) in south-eastern Caspian Sea basin using geometric morphometric. Journal of Animal Environment, 10(4):361-366. In Farsi.

Mouludi-Saleh, A., Abbasi, K., Eagderi, S., Sarpanah, A. and Vatandoust, S. 2020. Morphometric and meristic traits variation of *Alburnus chalcoides* populations in rivers of the southern Caspian Sea basin. Fisheries Science and Technology, 9(1):59-65. In Farsi.

Mouludi-Saleh, A. and Eagderi, S. 2019. Length-weight relationship and condition factor of ten fish species (Cyprinidae, Sisoridae, Mugilidae, Cichlidae, Gobiidae and Channidae) from Iranian inland waters. Journal of Wildlife and Biodiversity, 3(4):12-15.

Mouludi-Saleh, A. and Eagderi, S. 2021. Morphological comparison of *Squalius turcicus* and *S. namak* using geometric morphometric technique. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 4 pp. In Farsi.

Mouludi-Saleh, A., Eagderi, S., Abbasi, K. and Pourgholami, A. 2020. Comparison of some biological parameters of *Leuciscus aspius* (Linnaeus, 1758) from south-western part of the Caspian Sea. Journal of Fisheries (Iranian Journal of Natural Resources), 73(1):113-122. In Farsi.

Mouludi-Saleh, A., Eagderi, S., Abbasi, K. and Salavatian, S. M. 2021. Length-weight relationship and condition factor of ten cyprinid fish species from the Caspian Sea, Urmia Lake and Persian Gulf basins of Iran. Journal of Fisheries, 9(1):91401.

Mouludi-Saleh, A., Eagderi, S., Cicek, E. and Sungur, S. 2020. Morphological variation of Transcaucasian chub, *Squalius turcicus* in southern Caspian Sea basin using geometric morphometric technique. Biologia, 75(10):1585-1590.

Mouludi-Saleh, A., Eagderi, S., Latif-Nejad, Sh. and Nasri, M. 2020. The morphological study of transcaspian marinka (*Schizothorax pelzami*) in Harirud and Dasht-e Kavir basins using the geometric morphometric technique. Nova Biologica Reperta, 7(2):185-191. In Farsi.

Mouludi-Saleh, A. and Keivany, Y. 2018a. Morphological diversity in three species of chubs (*Squalius* spp.) populations in Iranian basins. Nova Biologica Reperta, 5(2):192-204. In Farsi.

Mouludi-Saleh, A. and Keivany, Y. 2018b. Length-weight and length-length relationships for three species of *Squalius* (Cyprinidae; Leuciscinae) from the Caspian Sea, Namak and Tigris basins of Iran. Journal of Applied Ichthyology, 34(5):1207-1209.

Mouludi-Saleh, A. and Keivany, Y. 2018c. Morphometric analysis of *Squalius namak* Khaefi et al. 2016 in Khaznagh and Ghare-Chai rivers. Sri Lanka Journal of Aquatic Sciences, 23(2):173-178.

Mouludi-Saleh, A., Keivany, Y. and Jalali, S. A. H. 2018. Comparison of meristic traits in Transcaucasian chub (*Squalius turcicus* De Filippi, 1865) from Caspian Sea basin. International Journal of Aquatic Biology, 6(1):8-14.

Moumeni, H., Raissy, M., Bashiri, M. and Barzegar, M. 2020. Fish-borne parasites: A review on the reports from Iran. Journal of Food Microbiology, 6(4):88-102. In Farsi.

Mounsey, A. H. 1872. A Journey through the Caucasus and the Interior of Persia. Smith, Elder & Co., London. xi + 336 pp.

Mousaei Sanjerehei, M. and Rundel, P. W. 2017. The future of Iranian wetlands under climate change. Wetlands Ecology and Management, 25(3):257-273.

Mousavi, B. S., Ojagh, S. M. and Alishahi, A. R. 2016. Effects of adding different percentages of carboxymethyl cellulose and tragacanth gum on textural and sensory characteristics of silver carp (*Hypophthalmichthys molitrix*) fried fish ball. Journal of Fisheries Science and Technology, 4(4):91-107. In Farsi.

Mousavi, H. A. E. 2000. Occurence of *Vibrio parahaemolyticus* in fresh water fish Farms (Iran). In: The 3rd World Fisheries Congress, Beijing, China, 31 Oct-2 Nov 2000 (abstract).

Mousavi, H. A. E. 2003. Parasites of ornamental fish in Iran. Bulletin of the European Association of Fish Pathologists, 23(6):297-300.

Mousavi, S. and Heidarieh, M. 2020. Effects of *Rosmarinus officinalis* commercial extract on some antioxidant and biochemical indices in gold fish (*Carassius auratus*). Journal of Fisheries (Iranian Journal of Natural Resources), 73(4):505-514. In Farsi.

Mousavi, S. F. and Samadi-Boroujeni, H. 1998. Evaluation of sedimentation in small dam reservoirs in Chaharmahal-Bakhtiary region. Iranian Journal of Science and Technology, Transactions A: Science, 24(4):421-430.

Mousavi, S. M., Ghaeidi, F., Zanguee, N. and Zakeri, M. 2019. Effects of different levels of cumin (*Cuminum cyminum*) extract on growth performance and nutritional indexes (*sic*) of juveniles of *Cyprinus carpio*. Journal of Experimental Animal Biology, 8(2):23-34. In Farsi.

Mousavi, S. M., Majdi Nasab, E., Yavari, V., Rajabzadeh Ghatrami, E. and Razi Jalali, M. 2013. Determination of toxicity and mean lethal concentration (LC_{50}) of eugenol on *Barbus sharpeyi*. Iranian Journal of Medicinal and Aromatic Plants, 29(3)(61):551-560. In Farsi.

Mousavi Gel Sefid, S. A., Keyvan, A. and Piri, M. 2007. Morphometric analysis of the common carp (*Cyprinus carpio* Linnaeus, 1758) in Anzali Lagoon, south west Caspian Sea. Iranian Scientific Fisheries Journal, 15(4):141-154. In Farsi.

Mousavi Nadoushan, R., Fatemi, M. R., Esmaeili Sari, A. and Vosoughi, Gh. H. 2008.

Determination of trophic status and potential of fish production in Lake Choghakhor. Journal of Fisheries, 2(2):71-74. In Farsi.
Mousavi Nadushan, R. and Ramezani, M. 2011. Bioassessment of Kordan Stream (Iran) water quality using macro-zoobenthos indices. International Journal of Biology, 3(2):127-134.
Mousavi-Sabet, H. 2013. De Iraanse blinde holenvis…. Aquariumwereld, 66(2):34-39. In Dutch.
Mousavi-Sabet, H. 2019. Exotic ornamental fishes in Iranian inland water basins: an updated checklist. Journal of Animal Diversity, 1(1):1-10.
Mousavi-Sabet, H., Abdollahpour, S., Salehi-Farsani, A., Vatandoust, S., Langroudi, H. F., Jamalzade, H. R. and Nasrollahzadeh, A. 2013. Length-weight and length-length relationships and condition factor of *Alburnus mossulensis* (Heckel, 1843) from the Persian Gulf basin. AACL Bioflux, 6(4):297-302.
Mousavi-Sabet, H., Abdollahpour, S., Vatandoust, S., Faghani-Langroudi, H., Salehi-Farsani, A., Salehi, M., Khiabani, A., Habibi, A. and Heidari, A. 2017. Reproductive biology of *Alburnus mossulensis* (Teleostei: Cyprinidae) in Gamasiab River, western Iran. Iranian Journal of Ichthyology, 4(2):171-180.
Mousavi-Sabet, H., AnvariFar, H. and Azizi, F. 2015. *Alburnoides tabarestanensis*, a new species of riffle minnow from the southern Caspian Sea basin in Iran (Actinopterygii: Cyprinidae). Aqua, International Journal of Ichthyology, 21(3):144-152.
Mousavi-Sabet, H. and Eagderi, S. 2014. First record of *Poecilia reticulata* Peters, 1859 (Cyprinodontiformes, Poeciliidae) from natural freshwaters of Iran. Poeciliid Research, 4(1):19-23.
Mousavi-Sabet, H. and Eagderi, S. 2016. *Garra lorestanensis*, a new cave fish from the Tigris River drainage with remarks on the subterranean fishes in Iran (Teleostei: Cyprinidae). FishTaxa, 1:45-54.
Mousavi-Sabet, H., Ganjbakhsh, B., Geiger, M. F. and Freyhof, G. 2016. Redescription of *Gobio nigrescens* from the Hari River drainage (Teleostei: Cyprinidae). Zootaxa, 4114(1):71-80.
Mousavi-Sabet, H., Habibi, A. and Bagherpur, O. 2013. Studies on length-weight and length-length relationships, relative condition factor and Fulton's condition factor of *Hemiculter leucisculus* (Pisces; Cyprinidae) from the southwestern Caspian Sea basin. Our Nature, 11(1):25-30.
Mousavi-Sabet, H. and Heidari, A. 2019. Morphological differentiation between two populations of Samiii's spirlin (*Alburnoides samiii*) in upstream and downstream of Sefidroud dam. Journal of Wetland Ecobiology, 11(1):23-32. In Farsi.
Mousavi-Sabet, H., Heidari, A., Khoshkholgh, M. R. and Esmaeili, H. R. 2013. Morphometric and meristic characteristics of a population of *Capoeta capoeta* (Pisces: Cyprinidae) in the Sefidroud River, from the southern Caspian Sea basin. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Mousavi-Sabet, H., Heidari, A., Mohammadi-Darestani, M., Mansouri-Chorehi, M. and Ghasemzadeh, K. 2016. Length-weight relationships and condition factors of two fish species from the southern Caspian Sea basin: *Alburnoides samiii* Mousavi-Sabet, Vatandoust & Doadrio, 2015 and *Ponticola iranicus* Vasli'eva, Mousavi-Sabet & Vasil'ev, 2015. Journal of Applied Ichthyology, 32(4):751-752.
Mousavi-Sabet, H., Heidari, A. and Salehi, M. 2018a. How did dams affect length-weight and length-length relationships of *Capoeta razii* (Cyprinidae) in Sefid River, the southern Caspian Sea basin? International Journal of Aquatic Biology, 6(5):274-280.
Mousavi-Sabet, H., Heidari, A. and Salehi, M. 2018b. How the selective breeding in aquaculture

programs can change the body shape of cyprinids; a case study on the native *Cyprinus carpio* and a cultured stock. International Journal of Aquatic Biology, 6(6):330-339.

Mousavi-Sabet, H., Heidari, A. and Salehi, M. 2019. Reproductive biology of the invasive sharpbelly, *Hemiculter leucisculus* (Basilewsky, 1855), from the southern Caspian Sea basin. Iranian Journal of Ichthyology, 6(1):31-40.

Mousavi-Sabet, H., Heidari, A. and Vatandoust, S. 2017. Length-weight and length-length relationships for 11 species of the genus *Alburnoides* Jeitteles, 1861 (*Cyprinidae*) from Iran. Journal of Applied Ichthyology, 33(3):609-612.

Mousavi-Sabet, H., Khataminejad, S., Sattari, M. and Vatandoust, S. 2013. Morphometric and meristic studies of kuli-ye Kura (Cyprinidae: *Alburnus filippii*) in the Baleqlu Chai River, northwestern of Iran. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Mousavi-Sabet, H., Khataminejad, S. and Vatandoust, S. 2014. Length-weight and length-length relations of the seven endemic *Alburnus* species (Actinopterygii: Cypriniformes: Cyprinidae) in Iran. Acta Ichthyologica et Piscatoria, 44(2):157-158.

Mousavi-Sabet, H., Saemi-Komsari, M., Doadrio, I. and Freyhof, J. 2019. *Garra roseae*, a new species from the Makran region in southern Iran (Teleostei: Cyprinidae). Zootaxa, 4671(2):223-239.

Mousavi-Sabet, H., Vatandoust, S. and Bleher, H. 2018. An updated checklist of fishes from the Iranian portion of the Harirud/Tedzhen River basin. Aqua, International Journal of Ichthyology, 24(4):167-184.

Mousavi-Sabet, H., Vatandoust, S. and Doadrio, I. 2015. Review of the genus *Alburnoides* Jeitteles, 1861 (Actinopterygii, Cyprinidae) from Iran with description of three new species from the Caspian Sea and Kavir basins. Caspian Journal of Environmental Sciences, 13(4):293-331.

Mousavi-Sabet, H., Vatandoust, S., Fatemi, Y. and Eagderi, S. 2016. Tashan Cave a new cave fish locality for Iran; and *Garra tashanensis*, a new blind species from the Tigris River drainage (Teleostei: Cyprinidae). FishTaxa, 1(3):133-148.

Mousavi-Sabet, H., Vatandoust, S., Khataminejad, S., Eagderi, S., Abbasi, K., Nasri, M., Jouladeh, A. and Vasil'eva, E. D. 2015. *Alburnus amirkabiri* (Teleostei), a new species of shemaya from the Namak Lake basin, Iran. Journal of Ichthyology, 55(1):40-52.

Mousavi-Sabet, H., Vatandoust, S. and Yerli, S. V. 2016. Endemic freshwater fishes of Iran. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Moussavi, M. and Saber, I. N. H. 1999. Mercury pollution in Kor River. Iranian Journal of Science and Technology, Transaction B: Technology, 23(3):165-172.

Movafagh Behnam, M., Esmaili Sari, A. and Majedi, S. M. 2020. Accumulation of mercury and zinc in muscle tissue of four species of fishes in Caspian Sea (Case study: coastal of Mahmoud Abad-Noshahr). Journal of Animal Environment, 12(3):183-188. In Farsi.

Movaghar, S. 1973. Iranocypris typhlops Kaiser the blind cave fish from Iran. Journal of the Veterinary Faculty of the University of Tehran, 29:43-50. In Farsi.

Movahedinia, A., Esmaeili Sari, A., Abtahi, B. and Ershad Langarudi, H. 2002. Seasonal changes in biomass and density of *Mnemiopsis leidyi* from Noor coastal waters of the Caspian Sea. Iranian Journal of Marine Sciences, 1(3):57-64, 74. In Farsi.

Movchan, Yu. V. and Kozlov, V. I. 1978. Morphological characters and certain ecological characteristics of the Chinese chebachok Pseudorasbora parva in Ukrainian reservoirs.

Hydrobiological Journal, 14(5):36-41.
Mozhdeganloo, Z. and Heidarpour, M. 2014. Oxidative stress in the gill tissues of goldfishes (*Carassius auratus*) parasitized by *Dactylogyrus* spp. Journal of Parasitic Diseases, 38(3):269-272.
Muhomedieva, F. D. 1967. Morfometriya i ekologiya zakaspiiskoi marinki *Schizothorax pelzami* Kessler pervogo Tedzhenskogo vodokhranilishcha [Morphometry and ecology of the Transcaspian marinka *Schizothorax pelzami* Kessler from the first Tedzhen water reservoir]. Voprosy Ikhtiologii, 7(6)(47):1060-1065.
Mukhaysin, A. A. and Jawad, L. A. 2012. Larval development of the cyprinid fish *Barbus sharpeyi* (Gunther, 1874). Journal of Fisheries and Aquatic Science, 7(5):307-319.
Munro, D. C. and Touron, H. 1997. The estimation of marshland degradation in southern Iraq using multitemporal Landsat TM images. International Journal of Remote Sensing, 18(7):1597-1606.
Murray-Rust, H., Salemi, H. R. and Droogers, P. 2002. Water Resources Development and Water Utilization in the Zayandeh Rud basin, Iran. Iranian Agricultural Engineering Research Institute, Karaj and International Water Management Institute, Colombo, Research Reports, 14:18 pp.
Musavi, M. and Pourebrahim, S. 2019. Water quality assessment based on biological monitoring of the Karaj River (Alborz province) using benthic macroinvertebrates. Journal of Animal Environment, 11(3):335-344. In Farsi.
Mustafayev, N. J., Ibrahimov, Sh. R. and Levin, B. A. 2015. Sharpbelly *Hemiculter leucisculus* (Basilewsky, 1855) (Cypriniformes, Cyprinidae) is a successful invasive species in freshwaters of Azerbaijan. Russian Journal of Biological Invasions, 2015(3):40-49. In Russian.
Muus, B. J. and Dahlstrøm, P. 1999. Freshwater Fish. Scandinavian Fishing Yearbook, Hedehusene, Denmark. New Edition, Re-edited by C. Coyne-Boragine, C. Frimodt, S. Skydsgaard, S. Weiss and E. Mogensen. 224 pp.
Myers, G. S. 1960. Preface to any future classification of the cyprinid fishes of the genus Barbus. Stanford Ichthyological Bulletin, 7(4):212-215.

N

Naama, A. K. and Muhsen, K. A. 1986. Feeding periodicites (*sic*) of the mugilid *Liza abu* (Heckel) and cyprinid *Carasobarbus luteus* (Heckel) from Al-Hammar Marsh, southern Iraq. Indian Journal of Fisheries, 33(3):347-350.
Nabavi, B., Rezaei Tavabe, K., Javanshir Khoei, A. and Samadi Kuchaksaraei, B. 2020. Investigation on the impacts of the rainbow trout (*Oncorhynchus mykiss*) farms effluents on eutrophic and saproby conditions of the Haraz River, Mazandaran Province. Journal of Aquaculture Sciences, 8(1):112-122. In Farsi.
Naddafi, R., Abdoli, A., Kiabi, B. H., Amiri, B. M. and Karami, M. 2005. Age, growth and reproduction of the Caspian roach (*Rutilus rutilus caspicus*) in the Anzali and Gomishan wetlands, North Iran. Journal of Applied Ichthyology, 21(6):492-497.
Naddafi, R., Amiri, B. M., Karami, M., Kiabi, B. H. and Abdoli, A. 2002a. A study of some ecological and biological characters of roach, *Rutilus rutilus caspicus*, in Anzali wetland. Iranian Journal of Natural Resources, 55(2):225-241. In Farsi.
Naddafi, R., Amiri, B. M., Karami, M., Kiabi, B. H. and Abdoli, A. 2002b. A study of some

biological characters of roach, *Rutilus rutilus caspicus*, in Gomishan wetland. Iranian Scientific Fisheries Journal, 11(3):103-126. In Farsi.

Naddafi, R., Amiri, B. M., Kiabi, B. H. and Abdoli, A. 2002. A comparative study of morphometric and meristic characters of the Caspian roach, *Rutilus rutilus caspicus*, in Gorgan-Rud estuary and Anzali Wetland, Iran. Iranian Journal of Natural Resources, 54(4):383-399. In Farsi.

Naderi, J. M. and Abdoli, A. 2004. Fish Species Atlas of South Caspian Sea Basin (Iranian Waters). Iranian Fisheries Research Organization, Tehran. 80 pp. + 10 pp. + 12 pp. In Farsi and English.

Naderi, M., Jafaryan, H., Gholipour, H., Harsig, M. and Farhangi, M. 2012. The microbial bioremediation of effluent of cultivation system for reuse in rearing tanks of common carp (*Cyprinus carpio*) larvae. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 477-484.

Naderi, M., Jafaryan, H., Gholipour, H., Harsig, M. and Farhangi, M. 2013. Innoculation of Bacillus to cultivation system of common carp fry for reuse in larviculture. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Naderi, M. N., Hadipour, E. and Mikalh, M. B. 2014. Numerical simulation of flow in fishway of Karkheh-Hammidieh diversion Dam. Advances in Environmental Biology, 8(16)(Special):183-191.

Naderi Farsani, H. R., Hajimoradloo, A., Taghizade, V. and Imanpoor, M. R. 2015. The effect of broccoli (*Brassica oleracea gemmifera* L.) in the diet on growth performance and some blood parameters of common carp (*Cyprinus carpio*). Journal of Animal Environment, 7(1):207-216. In Farsi.

Naderi Farsani, H. R., Hajimoradlo, A. M., Taghizadeh, V. and Imanpoor, M. R. 2017. The effects of broccoli powder (*Brassica oleracea* var. *Gemmifera* L.) on some indices of mucus on common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 5(3):33-46. In Farsi.

Naderi Farsani, M., Jenabi Haghparast, R., Shahbazi Naserabad, S., Moghadas, F., Bagheri, T. and Gerami, M. H. 2019. Seasonal heavy metal monitoring of water, sediment and common carp (*Cyprinus carpio*) in Aras Dam Lake of Iran. International Journal of Aquatic Biology, 7(3):123-131.

Naderi Gharahgheshlagh, S., Fatemi, M. J., Jamili, Sh., Nourani, A. M. and Nourani, M. R. 2020. Isolation and characterization of acid-soluble collagen from the skin of *Rutilus frisii kutum* (Kamensky) of the Caspian Sea. Iranian Journal of Fisheries Sciences, 19(2):768-779.

Naderi Gharehgheshlagh, S., Fatemi, M. J., Jamili, Sh., Nourani, M. R., Sharifi, A. M., Saberi, M., Amini, N. and Ganji, F. 2021. A dermal gel made of *Rutilus kutum* skin collagen-chitosan for deep burn healing. International Journal of Peptide Research and Therapeutics, 27(3):317-128.

Naderi Jeloudar, M., Esmaeili Sari, A., Ahmadi, M. R., Seyfabadi, S. J. and Abdoli, A. 2007. The effects of trout farm effluents on the water quality parameters of Haraz River. Environmental Sciences, 4(2):21-36. In Farsi.

Naderi Jolodar, M. 1999. Age, growth and feeding habits of fish *Leuciscus cephalus* in Tajan River. M.Sc. Thesis, Islamic Azad University, Tehran. 135 pp. In Farsi.

Naderi Jolodar, M. and Abdoli, A. 2004. Fish Species Atlas of South Caspian Sea Basin (Iranian

Waters). Iranian Fisheries Research Organization, Teheran.110 pp. In Farsi and English.
Naderi Jolodar, M., Abdoli, A., Mirzakhani, M. K. and Sharifi Jolodar, R. 2011. Benthic macroinvertebrates response in the Haraz River to the trout farms effluent. Journal of Fisheries (Iranian Journal of Natural Resources), 64(2):163-175. In Farsi.
Naderi Jolodar, M., Hashemian Seed, A., Roohi Kolahgar, A., Afraei Bandpei, M. A., Fazli, H. and Mokarammi, A. 2019. The role of macrobenthic invertebrates in feeding some bony fishes - the economic in the southeast coast of the Caspian Sea. Journal of Applied Ichthyological Research, 7(3):77-92. In Farsi.
Naderi Jolodar, M., Roohi, A. and Ebrahimzadeh, M. 2018. Growth characteristics and nutritional strategies of *Luciobarbus capito* in reservoir behind the Shahid Rajaee Dam of Sari, Iran. Journal of Fisheries Science and Technology, 7(1):1-7. In Farsi.
Naderi Jolodar, M., Roohi, A., Ebrahimzadeh, M. and Seyedeh, A. S. 2017. Growth and feeding behaviour of the tchanari-barbel (Cyprinidae, *Luciobarbus capito*, Güldenstàdt, 1773) in the Shahid Rajaei Reservoir (Sari, Iran). Ecology and Evolutionary Biology, 2(1):14-20.
Naderi Jolodar, M., Roohi, A., Tahami, F., Rowshantabari, M. and Afraei Bandpei, M. A. 2017. Natural reproduction of kutum *Rutilus kutum* (Kamenskii, 1901) in Nesarud and Kazemrud rivers with respect of the water quality in the shale venture method. Ecology and Evolutionary Biology, 2(2):21-24.
Naderi Jolodar, M., Roshantabari, M., Roohi, A., Afraei Bandpei, M. A., Fazli, H. and Hossainpour, H. 2020. Species diversity of fish in the Sanandaj Azad Dam ecosystem, Journal of Applied Ichthyological Research, 8(2):9-17. In Farsi.
Naderi Jolodar, M., Rouhi, A. and Parafkandeh Haghighi, F. 2016. The importance of Tejan River in protection of fish species of southern Caspian Sea. Journal of Aquatic Caspian Sea, 1 (2):25-34. In Farsi.
Naderi Jolodar, M., Salarvand, G., Abdoli, A. and Fazli, H. 2013. The feeding strategy of the Caspian Sea kutum (*Rutilus frisii kutum* Kamensky, 1901). Journal of Applied Ichthyological Research, 1(3):63-74. In Farsi.
Naderi Rad, N., Rezaei Tavabe, K. and Borghei, S. M. 2018. Investigation of possibility of treated urban wastewater in aquaculture of the common carp and the silver carp species and their effects on the quality parameters of wastewater (Case study: Mahdishahr wastewater treatment plant). Journal of Animal Environment, 10(2):183-188. In Farsi.
Naderi Samani, M., Jafarian, H. O., Gholipour Kanani, H. and Harsij, M. 2014. Bioremediation of the effluent of cultivation pond of common carp (*Cyprinus carpio* Linnaeus, 1758) using probiotic bacillus for reuse rearing system. Journal of Applied Ichthyological Research, 2(1):51-62. In Farsi.
Nadim, A. 1977. Study on the mercury content of fish and sea food in Iran. Iranian Journal of Public Health, 6(4):166-178. In Farsi.
Nadim, F., Bagtzoglou, A. C. and Iranmahboob, J. 2006. Management of coastal areas in the Caspian Sea region: environmental issues and political challenges. Coastal Management, 34(2):153-165.
Nadji, M. 1970. Die Kanat-Abflüsse im Iran als Basis eines neuen Verfahrens zur Berechnung der Grundwasserbilanz. Geologische Mitteilungen, 10:333-362.
Nadji, M. 1972a. Kanate in der Ebene von Kashan, Iran. Die Erde, Berlin, 102(314):209-215.
Nadji, M. 1972b. Geologie und Hydrogeologie des Gebietes von Kashan/Iran. Geologische Mitteilungen, 11:275-362.
Naeemi, A., Jamili, S., Shabanipour, N., Mashinchian, A. and Shariati Feizabadi, S. 2013.

Histopathological changes of gill, liver and kidney in Caspian kutum exposed to linear alkylbenzne sulfonate. Iranian Journal of Fisheries Sciences, 12(4):887-897.

Naeemi, A. S., Jamili, S., Shabanipour, N., Sotoodeh, M. P. and Salehzadeh, A. 2013. Histopathological change induced in the liver of the Caspian kutum fry after acute exposure to the anionic surfactant. European Journal of Zoological Research, 2(5):100-105.

Naeemi, A. S. and Shabanipour, N. 2017. Study of the respiratory vasculature of the silver carp (*Hypophthalmichthys molitrix*) gill by vascular casting and scanning electron microscopy (SEM). Journal of Wetland Ecobiology, 8(4):5-20, 113. In Farsi.

Naem, S. 1997a. A survey on the 4 species of parasitic leeches of Mahabad dam lake in Iran. Pajouhesh va Sazandegi, 36:124-127. In Farsi.

Naem, S. 1997b. A survey on the crustacean parasites of fishes of Mahabad reservoir dam lake with new records of *Tracheliastes polycolpus* in Iran. Pajouhesh va Sazandegi, 36:128-133. In Farsi.

Naem, S. 2002. The recognising of bronchial monogene parasite of fishes, in Sepidroud River in Guilan Province by introducing a new genus and four species for parasitic fauna Book of Abstracts, 27th World Veterinary Congress, September 25-29, 2002, Tunis-Tunisia (abstract).

Naem, S. and Meshkini, S. 2002. A survey on prevalence rate of diplostome spateceum (*sic*) metacercaria in *Cyprinus* fishes of Babol-Rood River, Iran. Book of Abstracts, 27th World Veterinary Congress, September 25-29, 2002, Tunis-Tunisia (abstract).

Naem, S., Mobedi, I., Khomirani, R. and Abolghasemi, S. J. 2002. A survey on gill parasites in cultured and wild fishes of western branch of Sepid-Rood river in Gilan province, Iran and introducing new species. Iranian Journal of Veterinary Research, Shiraz University, 3(2):118-128.

Naff, T. and Matson, R. C. (Eds.). 1984. Water in the Middle East. Conflict or Cooperation? Westview Press, Boulder and London. xvii + 236 pp.

Nahavandi, R., Amini, F. and Rezvani, S. 2001. Karyology of *Abramis brama* in the southern waters of Caspian Sea. Iranian Scientific Fisheries Journal, 10(3):89-100, 7. In Farsi.

Nahavandi, R., Pourgholam, R., Hassan, M. D., Soltani, M., Ghoroghi, A. and Pourgholam, H. 2006. Chemiluminescent response of grass carp (*Ctenopharyngodon idella*) following exposure to sublethal concentrations of diazinon. Iranian Journal of Fisheries Sciences, 6(1):57-68.

Na'imi, A. S. and Shabanipour, N. 2017. Study of the respiratory vasculature of the silver carp (*Hypophthalmichthys molitrix*) gill by vascular casting and scanning electron microscopy (SEM). Journal of Wetland Ecobiology, 8(4):5-20. In Farsi.

Najafi, A., Delangizan, S., Almasi, M. and Gharra, K. 2018. Assessment of productivity of warm water fish production factors in Kermanshah province farms. Iranian Scientific Fisheries Journal, 27(5):29-38. In Farsi.

Najafi, A., Salati, A. P., Yavari, V. and Asadi, F. 2014. Effects of short-term starvation and re-feeding on antioxidant defense status in *Mesopotamichthys sharpeyi* (Günther, 1874) fingerlings. International Journal of Aquatic Biology, 2(5):246-252.

Najafi, A., Salati, A. P., Yavari, V. and Asadi, F. 2015. Effects of short term fasting and refeeding on some hematological and immune parameters in *Mesopotamichthys sharpeyi* (Günther, 1874) fingerlings. Iranian Journal of Science and Technology, 39(A3)(Special Issue):383-389.

Najafi, A. and Vatanfada, J. 2011. Environmental change in trans-boundary waters, case study: Hamoon Hirmand Wetland (Iran and Afghanistan). International Journal of Water Resources and Arid Environments, 1(1):16-24.

Najafi, M., Zamani-Ahmadmahmoodi, R., Shaluei, F. and Ghorbani-Dashtaki, P. 2021. Evaluation of heavy metal pollution levels in the water of the Beheshtabad River. Journal of Wetland Ecobiology, 12(1):17-28. In Farsi.

Najafpoor, A. A., Vojoudi, Z., Dehgani, M. H., Changani, F. and Alidadai, H. 2007. Quality assessment of the Kashaf River in North East of Iran in 1996-2005. Journal of Applied Sciences 7(2):253-257.

Najafpour, N. 1994. Be familiar with fishes of Khuzestan. 2 Mahi hemri *Barbus luteus* (Heckel, 1843). Gozaresh Elmi (Scientific Report of the Iranian Fisheries Research and Training Organization), 1(2):7. In Farsi.

Najafpour, N. 1997. Identification of some freshwater fishes of Khuzestan Province. Fisheries Research Centre of Khuzestan Province, Iranian Fisheries Research and Training Organisation, Tehran. vi + 96 pp., 4 plates. In Farsi.

Najafpour, N. 2001. Diversity of fresh-water fishes of Khuzestan. The 10th European Congress of Ichthyology ECI X, Programme & Book of Abstracts, Prague, Czech Republic, September 3-7, 2001. p. 40.

Najafpour, N. 2002. Freshwater fishes of Khuzestan Province, I. R. Iran. Freshwater Biological Association Annual Scientific Meeting & Training Seminar, 4-6 September 2002, University of Durham, “Freshwater in the Landscape” (title).

Najafpour, N. 2003. Freshwater fishes of Khuzestan Province (Part II). Fisheries Research Centre of Khuzestan Province, Iranian Fisheries Research Organisation, Tehran.49 pp.

Najafpour, N. and Coad, B. W. 2002. Ichthyootoxism in *Barbus luteus* from Iran (Actinopterygii: Cyprinidae). Zoology in the Middle East, 26(1):129-131.

Najafpour, N., Eskandary, G., Nikpay, M. and Al-Mukhtar, M. 1997. Fresh water fishes of Khuzestan area. Ninth International Congress of European Ichthyologists (CEI9) “Fish Biodiversity”. Italy 1997 (Napoli-Trieste). Book of Abstracts, p. 64.

Najafpour, S., Alkarkhi, A. F. M., Rahman, N. N. N. A. and Golamipour, S. 2005. Organochlorine pesticides residues of kelthane, DDE and ß-BHC in freshwater of Tajan River (southern part of Caspian Sea). International Conference on Innovations and Technologies in Oceanography for Sustainable Development, 26-29 September 2005, Istana Hotel, Kuala Lumpur (title).

Najafpour, S., Alkarkhi, A. F. M., Rahman, N. N. N. A. and Nasrollahzadeh, H. S. 2005. Determination of chlorinated pesticides residues of DDT, lindane and a-BHC in freshwater of Tonekabon River (southern part of Caspian Sea). International Conference on Innovations and Technologies in Oceanography for Sustainable Development, 26-29 September 2005, Istana Hotel, Kuala Lumpur (title).

Najafpour, S., Alkarkhi, A. F. M., Rahman, N. N. N. A. and Rostami, H. A. Kh. 2005. Study of chlorinated pesticides residues of kelthane, ß-BHC and DDE in freshwater of Shiroud River (southern part of Caspian Sea). International Conference on Innovations and Technologies in Oceanography for Sustainable Development, 26-29 September 2005, Istana Hotel, Kuala Lumpur (title).

Najafipour, S., Bahmani, M., Oryan, S. and Nejatkhah, P. 2008. Determining the levels of 17-αhydroxy progesterone hormone and its relationship with some biological indexes (*sic*) in female brood kutum roaches (*Rutilus frisii kutum*) in west of Gilan. Journal of

Environmental Science and Technology, 36(special issue).
Najar Lashgari, S., Khara, H., Nezami Balouchi, S. A. and Saeidi, A. A. 2007. A survey of the characteristics the sperm of producers of the white fish (*Rutilus frisii kutum*) migrating to the Khoshkrood River. Journal of Biology Science, 1(1)(series no. 1):75-84. In Farsi.
Najari, H. 2003. International Wetland of Isfahan: Gavkhooni. Environmental Organization, Tehran. 31 pp. In Farsi.
Naji, T., Atef Yekta, A. and Kaivan, A. 2013. LC_{50} determination of ferrous iron (Fe^{2+}) in common carp (*Cyprinus carpio*). Journal of Environmental Science and Technology, 14(4):161-170. In Farsi.
Naji, T., Oryan, S. and Karami, S. 2007. Determining LC50 of cobalt chloride of *Cyprinus carpio*. Journal of Environmental Science and Technology, 8(4)(31):51-57. In Farsi.
Naji, T., Safaeian, Sh., Rostami, M. and Sabrjou, M. 2007. Toxic effect of zinc sulfate on gill tissues of common carp (*Cyprinus carpio*). Journal of Environmental Science and Technology, 9(2)(33):29-36. In Farsi.
Najmaii, M. 2004. Dams and environment. Iranian Large Dams Committee, Department of Energy, Tehran. 385 pp. In Farsi.
Namatollahi, M. A. 2010. Net confinement stress response in common carp (*Cyprinus carpio* L.). Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):39-47. In Farsi.
Namazi, S. 2000. The Caspian's environmental woes, pp. 120-136. In: Amirahmadi, H. (Ed.). The Caspian Region at a Crossroad. Challenges of a New Frontier of Energy and Development. St. Martin's Press, New York. xii + 299 pp.
Namroodi, S., Boozarpour, S., Harsij, M. and Kolangi Miandare, H. 2016. The effects of sublethal concentrations of cadmium on liver and gill of *Cyprinus carpio*. Journal of Utilization and Cultivation of Aquatics, 5(3):65-76. In Farsi.
Nanvazadeh, H., Khodayar, M. J., Jahangiri, A., Rahbar, N., Behfar, A. and Dehbashi, F. 2017. Determination of total mercury in common carp, *Cyprinus carpio*, large scaled barb, *Barbus grypus*, tiger tooth croaker, *Otolithes ruber* and from surface waters in Khuzestan, Iran. Iranian Journal of Fisheries Sciences, 16(2):844-850.
Naqshbandi, N. and Askari Hesni, M. 2017. Effect of chlorpyrifos organophosphate pesticide on haematological indices of grass carp *Ctenopharyngodon idella* (Valenciennes, 1844). Journal of Applied Ichthyological Research, 5(3):133-146. In Farsi.
Naqshbandi, N., Qasemifar, E. and Moameni, L. 2017. Effect of lead on blood and biochemical factors on common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 40-47. In Farsi.
Narges, R., Ebrahimi, E., Mahboobi-Soofiani, N. and Farhadian, O. 2019. Trophic status of Zayandeh-rood dam water (Isfahan) during autumn and winter of 2010-2011. Journal of Animal Environment, 11(2):371-378. In Farsi.
Narjes Tabatabaei, S., Abdoli, A., Hashemzadeh Segherloo, I., Entezari Idehloo, S., Milani, M. and Mirzaei, I. 2013. Analysis of age and growth, length-weight relationship and condition factor of Spirlin (Cyprinidae: *Alburnoides namaki*) in Namak Basin-Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 65 (abstract).
Narjes Tabatabaei, S., Eagderi, S., Hashemzadeh Segherloo, I. and Abdoli, A. 2013. Geometric and morphometric analysis of fish scales to identify genera, species and populations case study: the Cyprinidae family. Journal of Taxonomy and Biosystematics, 5(17):1-8, 1. In Farsi.

Narjes Tabatabaei, S., Eagderi, S., Kaboli, M., Javanshir, A., Hashemzadeh Segherloo, I., Zamani, M., Salahinejad, A. and Shekari, H. 2014. Length-weight relationship and condition factor of fish assemblage of Kordan River (Namak Lake basin). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Narjes Tabatabaei, S., Eagderi, S., Poorbagher, H., Hashemzadeh Segherloo, I., Zamani, M., Salahinejad, A. and Shekari, H. 2014. Assessment of some effective environmental variables on fish assemblage in Kordan River (Namak Basin). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Narjespour, F. and Oloomee, Y. 1990. Artificial reproduction of roach, *Rutilus rutilus caspicus*. B.Sc. Project, University of Gorgan, Gorgan. In Farsi.

Nasari Tajan, M. 1996. Determination of the lethal concentration of LC_{50}96 h toxicity of diazinon granol 5% and emulsion 60% on *Abramis brama*. M.Sc. Thesis, Lahijan Azad University, Iran.

Naseka, A. M. 1996. Comparative study on the vertebral column in the Gobioninae (Cyprinidae, Pisces) with special reference to its systematics. Publicaciones Especiales Instituto Español de Oceanografía, 21:149-167.

Naseka, A. M. 2010. Zoogeographical freshwater divisions of the Caucasus as a part of the West Asian Transitional Region. Proceedings of the Zoological Institute, Russian Academy of Sciences, 314(4):469-492.

Naseka, A. and Bogutskaya, N. 2011. Annotated bibliography of bighead *(Hypophthalmichthys nobilis*) and silver (*Hypophthalmichthys molitrix*) carps from Russian-language literature. Canadian Manuscript Report of Fisheries and Aquatic Sciences, 2964:vi + 79 pp.

Naseka, A. M. and Bogutskaya, N. G. 2009. Fishes of the Caspian Sea: zoogeography and updated check-list. Zoosystematica Rossica, 18(2):295-317.

Naseka, A. M. and Freyhof, J. 2004. *Romanogobio parvus*, a new gudgeon from River Kuban, southern Russia (Cyprinidae, Gobioninae). Ichthyological Exploration of Freshwaters, 15(1):17-23.

Naseri, M. 2014. Lipid and chemical composition changes in different sterilization conditions of canned silver carp (*Hypophthalmichthys molitrix*). Journal of Utilization and Cultivation of Aquatics, 3(2):79-98. In Farsi.

Naseri, M. and Afsharnaderi, A. 2014. Effect of different heating treatments during canning on the amounts of some mineral elements (iron, zinc, copper, calcium and sodium) of silver carp (*Hypophthalmichthys molitrix*). Journal of Utilization and Cultivation of Aquatics, 3(1):35-54. In Farsi.

Naserizadeh, M., Safai, O. and Nematollahi, M. A. 2013. First report on the abnormality among body component ratios in the caught Caspian Sea mahisefid (*Rutilus frissi* (*sic*) *kutum*, Kamensky, 1901). Turkish Journal of Fisheries and Aquatic Sciences, 13(2):383-387.

Nash, C. 1997a. Iran develops farm skills to meet fishing needs. Fish Farming International, 24(4):26-28.

Nash, C. 1997b. Iran goes private! - moving fisheries out of state control. Fish Farming International, 24(5):38-39.

Nasipour, M., Mohammadian, T., Tabandeh, M. R. and Mesbah, M. 2017. Effects of synbiotic with different levels of βglocan and mananoligosaccharide with *Lactobacillus casei* on some gastrointestinal enzymes activity of *Cyprinus carpio*. Journal of Animal

Environment, 8(4):179-188. In Farsi.
Nasir, N. A., Naama, A. K. and Al-Saboonchi, A. 1989. The distribution, length-weight relationships, food and feeding of the cyprinid fish *Barbus sharpeyi* from Al-Hammar Marsh, Iraq. Fisheries Research, 7(1-2):175-181.
Nasrallah, H. A. and Balling, R. C. 1993. Spatial and temporal analysis of Middle Eastern temperature changes. Climatic Change, 25(2):153-161.
Nasri, M. 2008. Taxonomy of bigmouth lotak (*Cyprinion macrostomum* Heckel, 1843) and smallmouth lotak (*Cyprinion kais* Heckel, 1843) in Karkheh River basin and Godarkhosh River in Ilam province. M.Sc. Thesis, Isfahan University of Technology. 112 pp. In Farsi.
Nasri, M. 2015. Phylogeography of the genus *Cyprinion* in Iran. Ph.D. Thesis, University of Tehran. In Farsi.
Nasri, M. 2021. Is *Capoeta aculeata* (Valenciennes, 1844) a proper biological indicator for water quality assessment in Khorram-rud River? The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.
Nasri, M. and Eagderi, S. 2013. Geometric morphometric comparison of (Cyprinidae: *Cyprinion macrostomum* and *Cyprinion watsoni*) in Tigris and Hormuz basins using Canonical Variate Analysis. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 88 (abstract).
Nasri, M. and Eagderi, S. 2018. Effects of aquaculture activities on the species composition of native fishes of Eivashan River, Lorestan Province. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Nasri, M., Eagderi, S. and Farahmand, H. 2014. Interspecies morphological variation of *Cyprinion watsoni* (Day, 1872) from southern and southeastern inland water basins of Iran based on geometric morphometric method. Journal of Applied Ichthyological Research, 2(2):1-14. In Farsi.
Nasri, M., Eagderi, S. and Farahmand, H. 2016a. Geometric morphometric comparison of neurocranium and its ability to identify various species of Iranian *Cyprinion* genus. Journal of Applied Ichthyological Research, 3(4):19-34. In Farsi.
Nasri, M., Eagderi, S. and Farahmand, H. 2016b. Descriptive and comparative osteology of bighead lotak, *Cyprinion milesi* (Cyprinidae: Cypriniformes) from south-eastern Iran. Vertebrate Zoology, 66(3):251-260.
Nasri, M., Eagderi, S., Farahmand, H. and Hashemzadeh Segherloo, I. 2013. Body shape comparison of *Cyprinion macrostomum* (Heckel, 1843) and *Cyprinion watsoni* (Day, 1872) using geometric morphometrics method. International Journal of Aquatic Biology, 1(5):240-244.
Nasri, M., Eagderi, S., Farahmand, H. and Nezhadheydari, H. 2019. Interspecific morphological variation among members of the genus *Cyprinion* Heckel, 1843 species (Teleostei: Cyprinidae) in Iran, using landmark-based geometric morphometric technique. Iranian Journal of Ichthyology, 6(1):54-64.
Nasri, M., Eagderi, S., Keivany, Y., Farahmand, H., Dorafshan, S. and Nezhadheydari, H. 2018. Morphological diversity of *Cyprinion* Heckel, 1843 species (Teleostei: Cyprinidae) in Iran. Iranian Journal of Ichthyology, 5(2):96-108.
Nasri, M., Keivany, Y. and Dorafshan, S. 2008. Comparison of pharyngeal teeth and gill rakers of bigmouth lutak, *Cyprinion macrostomum* Heckel, 1843 in Karkheh River basin. Third

International Conference of Biology in Iran, University of Tehran.
Nasri, M., Keivany, Y. and Dorafshan, S. 2010. First karyological analysis of smallmouth lotak, *Cyprinion kais* Heckel, 1843, an endemic cyprinid fish from the Tigris-Euphrates basin. Italian Journal of Zoology, 77(3):272-276.
Nasri, M., Keivany, Y. and Dorafshan, S. 2013. Comparative osteology of lotaks, *Cyprinion kais* and *C. macrostomum* (Cypriniformes, Cyprinidae), from Godarkhosh River, western Iran. Journal of Ichthyology,53(6):455-463.
Nasri, M., Keivany, Y. and Dorafshan, S. 2015. Karyological analysis of *Cyprinion macrostomum* Heckel, 1843, from Godarkhosh River, Ilam Province, Iran. Iranian Journal of Fisheries Sciences, 14(3):786-796.
Nasri-Chaari, A. 1993. Status of aquaculture in Mazandaran. Abzeeyan, Tehran, 4(3):34-37, XIII. In Farsi.
Nasri-Chaari, A. 1994. Prevention of eventual destruction of river ecosystems in northern regions of Iran. Abzeeyan, Tehran, 5(3 & 4):31-33, IV. In Farsi.
Nasri-Tajan, M. 1997. Determination of lethal concentration of toxin (organophosphate insecticide), diazinon granule 5 percent and emulsion 60 percent on the *Abramis brama* population in Anzali lagoon. M.Sc. Thesis, Lahijan Islamic Azad University.
Nasri Tajan, M. and Taati, R. 2010. Length-weight relationship in rudd (*Scardinius erythrophthalmus*) in Anzali wetland. Journal of Wetland Ecobiology, 1(4):59-63. In Farsi.
Nasrolah Pourmoghadam, M., Poorbagher, H. and Eagderi, S. 2019. Assessment of habitat suitability index of *Capoeta* species in the Caspian Sea and Namak Lake basins, Iran. International Journal of Aquatic Biology, 7(3):146-154.
Nasrolahzadeh, A. and Alaf Navirian, H. 2014. The effect of different level of reed plant root (*Phragmites australis*) as a supplementary food component on growth and feed efficiency of young common carp (*Cyprinus carpio*). Journal of Animal Researches (Iranian Journal of Biology), 26(4):490-497. In Farsi.
Nasrolazadeh Saravi, H. 2001. Determination of oil pollution rate in southern Caspian Sea (from Tonekabon to Bandar Torkaman). Iranian Scientific Fisheries Journal, 10(1):91-102. In Farsi.
Nasrollahzadeh, A. 1999. Zur Süßwasserfauna des Gilan (Iran). Zoology in the Middle East, 17(1):91-98.
Nasrollahzadeh, A. 2010. Caspian Sea and its ecological challenges. Caspian Journal of Environmental Sciences, 8(1):97-104.
Nasrollahzadeh, A. 2021. Environmental ecology for fish in the Anzali wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.
Nasrollahzadeh, A., Noveriyan, H. A., Khoshkholgh, M. R., Mosapour Shajani, M. and Shakouriyan, M. 2014. The effects of *Spirulina platensis* levels in diet on growth indices and chemical body composition of kutum fry (*Rutilus frisii kutum*). Journal of Fisheries, 67(3):445-453, 11. In Farsi.
Nasrollahzadeh, H. S., Rezvani, S., Rostami, H. A., Unesipour, H., Laloei, F., Pardakhti, A. R., Zinatizadeh, A. A., Zahed, M. A. and Najafpour, S. H. 2005. Studies on the accumulation of petroleum-derived polycyclic aromatic hydrocarbons (PAHs) in muscles of two bony fish in Caspian Sea, Iran. International Conference on Innovations and Technologies in

Oceanography for Sustainable Development, 26-29 September 2005, Istana Hotel, Kuala Lumpur (title).

Nasrollahzadeh Saravi, H. 2013a. Study of physico-chemical characteristics of water in the southern Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 104 pp. In Farsi.

Nasrollahzadeh Saravi, H. 2013b. Hydrology, hydrobiology and environmental pollution in the southern of Caspian Sea. Iranian Fisheries Science Research Institute, Tehran. 227 pp. In Farsi.

Nasrollahzadeh Saravi, H., Makhlough, A., Farabi, S. M. V. and Pourang, N, 2019. A brief overview of climate change and aquatic environments with emphasis on the Caspian Sea. Iranian Scientific Fisheries Journal, 28(6):159-164. In Farsi.

Nasrollahzadeh Saravi, H., Makhlough, A., Yaghobzadeh, Z. and Ghiyasi, M. 2017. Comparative study of water quality indices in Shahid Rajaee Dam Reservoir (Sari, Mazandaran Province). Journal of Water and Wastewater, 28(2):78-88. In Farsi.

Nasrollahzadeh Saravi, H., Makhlough, A., Yaghobzadeh, Z., Safari, R. and Hosseinpour, H. 2020. Study on relationship between limnological parameters and water quality indices at Sanandaj Azad Dam due to fisheries activities. Iranian Scientific Fisheries Journal, 29(1):1-11. In Farsi.

Nasrollahzadeh Saravi, H., Parafkandeh, F., Fazli, H., Mirzaei, R., Hosseinpour, H., Afraei, M. A., Nasrollahtabar, A., Makhlough, A. and Vahedi, N. 2017. Study on physico-chemical characteristics of Azad dam reservoir (Sanandaj) in order to fisheries activities. Iranian Scientific Fisheries Journal, 25(5):143-157. In Farsi.

Nasrollahzadeh Saravi, H., Pourgholam, R., Unesipour, H. and Makhlough, A. 2012. Study of polyaromatic hydrocarbons (16PAHs) at the sediments and edible tissue of *Liza saliens* and *Rutilus frisii kutum* of the Caspian Sea. Journal of Mazandaran University of Medical Sciences, 22(94):79-89. In Farsi.

Nasrollahzadeh Saravi, H., Unesipour, H. and Pourang, N. 2014. Polycyclic aromatic hydrocarbons (16PAHs) residue and potency equivalency factor in edible tissue of *Cyprinus carpio* from Caspian Sea. Journal of Mazandaran University of Medical Sciences, 24(113):209-214. In Farsi.

Nassiri, A., Noora, S. and Hosseini, S. M. 2018. A review of parasite infections prevalence in ornamental fishes in Iran. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Nateghi, S., Mostefavi, H., Akbar Matkan, A., Aghighi, H. and Valavi, R. 2017. Investigating climate change effects on the distribution of *Alburnus namaki* under different climatic scenarios in Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 703-706. In Farsi.

Navirian, H., Sotohian, F. and Mostafazadeh, S. 2011. The effect of different levels of natural zeolite on growth indices of juvenile Caspian frisii kutum (*Rutilus frisii kutum*, Kamenskii, 1901). Iranian Journal of Biology, 24(1):155-161. In Farsi.

Nazari, H. and Abdoli, A. 2010. Some reproductive characteristics of endangered Caspian lamprey (*Caspiomyzon wagneri* Kessler, 1870) in the Shirud River southern Caspian Sea, Iran. Environmental Biology of Fishes, 88(1):87-96.

Nazari, K. 2002. Identification of different fish species in Kargan-rood River on Guilan Province, 1994. Iranian Scientific Fisheries Journal, 11(1):73-84. In Farsi.

Nazari, M., Alishahi, M., Mohammadian, T. and Motamedi, H. 2016. In vitro probiotic effects of

some phytase producing bacteria in fish (*Cyprinus carpio*). Journal of Animal Environment, 8(3):93-102. In Farsi.

Nazari, R. M. 1996. Biology and propagation of silver carp. Ranghineh-Afrouz, Tehran. 94 pp. In Farsi.

Nazari, S., Paknejad, H., Jalali, A. and Khorshidi, Z. 2021. Molecular genetic divergence of five genera of cypriniform fish in Iran assessed by DNA barcoding. Iranian Journal of Fisheries Sciences, 20(3):628-645.

Nazari, S., Pourkazemi, M. and Rebelo Porto, J. I. 2009. Comparative karyotype analysis of two Iranian cyprinids, *Alburnoides bipunctatus* and *Alburnus filippii* (Cypriniformes, Cyprinidae). Iranian Journal of Animal Biosystematics, 5(2):23-32.

Nazari, S., Pourkazemi, M. and Rebelo Porto, J. I. 2011. Chromosome description and localization of nucleolus organizing regions (NORs) by Ag-staining technique in *Alburnus filippii* (Cyprinidae, Cypriniformes) in Anzali Lagoon, north Iran. Iranian Journal of Fisheries Sciences, 10(2):352-355.

Nazari, T., Yavari, V., Salati, A. P. and Movahedinia, A. 2015a. Effect of air exposure on some hematological and biochemical responses in *Mesopotamichthys sharpeyi* fingerlings. Journal of Aquaculture Development, 9(2):81-88. In Farsi.

Nazari, T., Yavari, V., Salati, A. P. and Movahedinia, A. 2015b. Effect of density on some physiological responses to transportation stress in *Mesopotamichthys sharpeyi* (Günther 1874) fingerlings. International Journal of Aquatic Biology, 2(5):331-338.

Nazari Chamak, F., Pazouki J., Ebrahimi, M. and Masoumian, M. 2010. *Capoeta damascina* of Halil-Rud River, a new host for Myxozoan parasites. Journal of Veterinary Research, 64(4):323-327. In Farsi.

Nazarpour, M., Askary Sary, A., Javaheri Baboli, M. and Velayatzadeh, M. 2015. Fatty acids composition in raw muscle and barbecue of *Cyprinus carpio*. New Technologies in Aquaculture Development (Journal of Fisheries), 9(3):9-18. In Farsi.

Nazifi, S., Firoozbakhsh, F. and Bolouki, M. 2000. Evaluation of serum biochemical parameters in experimental intoxication with trichlorofan (*sic*) in silver carp (*Hypophthalmichthys molitrix* Valenciennes). Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(3):55-60. In Farsi.

Nazifi, S., Firozbakhsh, F. and Ghazizadeh, M. 2001. Evaluation of hematological parameters in experimental intoxication with trichlorofen (*sic*) in the silver carp. Journal of the Faculty of Veterinary Medicine, University of Tehran, 56(2):23-27. In Farsi.

Nedaei, S., Eagderi, S. and Poorbagher, H. 2014. Morphological comparison of two populations of *Capoeta capoeta* (Güldenstädt, 1773) from Aras and Sefidrood Rivers in the Caspian Sea basin. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Nedoshivin, A. Ya. and Iljin, B. S. 1927. Ulovy krasnoi ryby v vodakh yuzhnogo poberezh'ya Kaspiya v 1913-1915 g.g. (Iz rabot Kaspiiskoi ekspeditsii 1914-1915 g.g.) [Ganoid fish catches in the waters of the southern coast of the Caspian Sea in 1913-1915 (from the works of the Caspian Expedition 1914-1915)]. Izvestiya Otdela prikladnoi ikhtiologii i nauchno-promyslovykh issledovanii, Leningrad, 7(1):5-100.

Nedoshivin, A. Ya. and Iljin, B. S. 1929. Rybolovstvo v vodakh yuzhnogo Kaspiya (arendyemykh firmoi "Naslednikhi Lianozova") [Fisheries in the southern waters of the Caspian Sea (held by the firm "Lianozov Heirs"]. Trudy Instituta Rybnogo Khozyaistva i Promyslovykh Issledovanii, Leningradskoe Otdelenie, 1:5-142.

Negarestan, H., Hoseini, S., Rouhi, A., Bagheri, S., Pajand, Z. and Ghasemi, S. 2002. Presence of the ctenophore *Mnemiopsis leidyi* in south Caspian Sea. First International Meeting "The invasion of the Caspian Sea by the comb jelly Mnemiopsis - problems, perspectives, need for action", Baku, Azerbaijan, 24-26 April 2001. Caspian Environment Programme, Baku, Azerbaijan. 4 pp.

Nejad Moghaddam, Sh., Imanpoor, M. R., Jafari, V. A. and Safari, R. 2018. Effects of dietary nettle *Urtica dioica* hydroalcoholic extract on some hematological and biochemical parameters in goldfish *Carassius auratus*. Journal of Animal Environment, 10(2):189-196. In Farsi.

Nejat, S. A., Hermidas Bavand, D. and Farschi, P. 2018. Environmental challenges in the Caspian Sea and international responsibility of its littoral states. Caspian Journal of Environmental Sciences, 16(2):99-112.

Nejati Javaromi, M., Kazemian, M. and Vatandoust, S. 2009. Morphological diversity among the *Vimba vimba persa* population along the southern region of the Caspian Sea. Journal of Marine Biology, 1(3):40-53. In Farsi.

Nejatkhah, O., Oryan, Sh., Rostaeian, A., Naghshineh, R. and Fatemi, M. R. 2003. Bloom of phytoplanktons in Anzali Lagoon and identification of poisonous algae. Iranian Scientific Fisheries Journal, 12(2):95-110. In Farsi.

Nejatsanatee, A. R. 1994. Ameerkalaye Lagoon in Lahijan, Abzeeyan, Tehran, 5(1 & 2):2-4, II-III. In Farsi.

Nejatsanati, A. R. and Zamani, A. A. 2017. Effects of hydro-alcoholic extract of *Matricaria recutita* and *Foeniculum vulgare* on indices of hematology and immunity parameters of *Cyprinus carpio*. Journal of Aquaculture Development, 11(4):105-121. In Farsi.

Nekoubin, H., Hajimoradloo, A. and Hoseinifar, S. H. 2020. Effects of apple cider vinegar on growth performance and non-specific immune parameters of skin mucus in common carp (*Cyprinus carpio*) fingerlings. International Journal of Aquatic Biology, 8(5):311-316.

Nekoubin, H., Hosseinzadeh, M., Keyvanlou, S. and Sudagar, M. 2014. Effect of L-carnitine food additive on growth indices and body composition of Caspian Sea kutum (*Rutilus frisii kutum*). Journal of Animal Environment, 6(1):67-72. In Farsi.

Nekoubin, H. and Sudagar, M. 2012a. Effect of formulate and plant diets on growth performance and survival rate of juvenile grass carp (*Ctenopharyngodon idella*). World Journal of Fish and Marine Sciences, 4(4):386-389.

Nekoubin, H. and Sudagar, M. 2012b. Assessment of the effects of synbiotic (biomin imbo) via supplementation with artificial diet (with different protein levels) on growth performance and survival rates in grass carp (*Ctenopharyngodon idella*). World Journal of Zoology, 7(3):236-240.

Nekoubin, H. and Sudagar, M. 2013. The investigation of body composition and fatty acids in muscle of grass carp (*Ctenopharyngodon idella*) fed with *Lemna* sp., *Azolla filiculoides* and alfalfa and pellet. Journal of Animal Environment, 5(3):35-42. In Farsi.

Nelson J. S. 1994. Fishes of the World. 3rd Edition. John Wiley & Sons, New York. xvii + 600 pp.

Nelson, J. S. 2006. Fishes of the World. Fourth Edition. John Wiley & Sons, New York. xix + 601 pp.

Nelson, J. S., Grande, T. C. and Wilson, M. V. H. 2016. Fishes of the World. Fifth Edition. John Wiley & Sons, Hoboken. xli + 707 pp.

Nelva, A. Collares-Pereira, M-J. and Coelho, M. 1988. Systematique et repartition du genre

Chondrostoma Agassiz, 1835 (Pisces, Cyprinidae). Archiv für Hydrobiologie, 113(1):93-112.

Nasehi, F., Hassani, A., Monavvari, M., Karbassi, A., Khorasani, N. and Imani, A., 2012. Heavy metal distribution in water of the Aras River, Ardabil, Iran. Journal of Water Resources and Protection, 4(2):73-78.

Nasehi, F., Monavari, M., Naderi, Gh., Vaezi, M. A. and Madani, F. 2013. Investigation of heavy metals accumulation in the sediment and body of carp fish in Aras River. Iranian Journal of Fisheries Sciences, 12(2):398-410.

Nejatkhah Manavi, P. and Kiadehy, M. M. 2015. Monitoring lindane pesticide in muscles of (*Cyprinus carpio*, *Rutilus frisii kutum* and *Liza aurata*) in the southern coast of the Caspian Sea. Journal of Oceanography, 6(23):1-7. In Farsi.

Nematdoost Hagi, B. and Banaee, M. 2016. Effect of effluent of Pars Paper Industries (Khuzestan) on liver biochemical parameters of *Alburnus mossulensis*. Journal of Aquatic Ecology, Hormozgan University, 6(1):143-147. In Farsi.

Nemati, M., Shabanpour, B., Shaabani, A. and Gholizadeh, M. 2009. The effect of cold storage on lipid quality and sensory evaluation of fish burgers made from carp (*Cyprinus carpio*) surimi and red meat. Journal of Agricultural Sciences and Natural Resources, 16(special issue 1-A):108-117. In Farsi.

Nemati, T., Johari, S. A. and Sarkheil, M. 2019. Will the antimicrobial properties of ZnONPs turn it into a more suitable option than AgNPs for water filtration? Comparative study in the removal of fish pathogen, *Aeromonas hydrophila* from the culture of juvenile common carp (*Cyprinus carpio*). Environmental Science and Pollution Research, 26:30907-30920.

Nematollahi, A., Ahmadi, A., Mohammadpour, H. and Ebrahimi, M. 2013. External parasitic infection of common carp (*Cyprinus carpio*) and big head (*Hypophthalmichthys nobilis*) in fish farms of Mashhad, northeast of Iran. Journal of Parasitic Diseases, 37(1):131-133.

Nematollahi, A., Akbarian, A., Nafian, I. and Mokhtari, A. 2014. Morphological study of the gill blood vessels of common carp (*Cyprinus carpio*) using corrosion cast study. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Nematollahi, A., Mohebbi, A., Naderi, S. and Akbarian, A. 2013. Isolation and characterization of macrophages from the Mesopotamian barb (Cyprinidae: *Capoeta damascina*) spleen and kidney head. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 90 (abstract).

Nematollahi, A., Nafian, I., Akbarian, A. and Khosravi, Y. 2014. Isolation and characterization of macrophages from goldfish (*Carassius auratus*) head kidney and spleen by density-gradient separation. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Nematollahi, A. and Shadkhast, M. 2013. Comparison of various methods of corrosion cast study in silver carp (*Hypophthalmichthys molitrix*) circulatory system. Journal of Applied Ichthyological Research, 1(1):1-14, 1. In Farsi.

Nematollahi, A., Shafiei, S., Kabiri, J. and Safarpour, R. 2017. Effects of transport stress on grass carp (*Ctenopharyngodon idella*) with benzocaine hydrocholoride anesthesia. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 180-184. In Farsi.

Nematollahi, M., van Pelt-Heerschap, H. and Komen, J. 2010. Inheritance of congenital interrenal hyperplasia (CIH) in common carp (*Cyprinus carpio*). 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Nematollahi, M. A., de van Pelt, H. and Komen, J. 2013. Response to stress in 17-hydroxylase deficient common carp (*Cyprinus carpio* L.). Journal of Agricultural Science and Technology, 15(2):303-310.

Nematollahi, M. A., van Pelt, H. and Komen, H. 2006. Stress response during and after confinement in 17 alpha hydroxylase deficient common carp (*Cyprinus carpio*). VIIth International Congress on the Biology of Fish, St. John's, Newfoundland, 19-22 July 2006 (abstract).

Nemrodi, S., Bouzarpour, S., Haresij, M. and Paknejad, H. 2018. Investigating the effect of sub-lethal concentrations of cadmium on gene expression of cytochrome P450 CYP1A in the liver and gill tissues *Cyprinus carpio*. Journal of Applied Ichthyological Research, 6(2):61-72. In Farsi.

Nesar Hosseini, S. and Askary Sary, A. 2014. Zinc hazard quotient (HQ) determination in muscle of four species of carp cultured from Khuzestan Province. Breeding and Aquaculture Sciences Quarterly, 2(4):77-90. In Farsi.

Nesbitt, A. P. and Bawa, K. S. 1960. "Ghanat" water collection system. The Military Engineer, 52(350):463-466.

Nesbitt, A. P. and Bawa, K. S. 1961. "Ghanat" water collection system. Mines Magazine, Golden, Colorado, 1961:27-30.

Neumann, D. 2006. Type catalogue of the Ichthyological Collection of the Zoologische Staatssammlung München. Part I: Historic type material from the "Old Collection", destroyed in the night 24/25 April 1944. Spixiana, 29(3):259-285.

Neumann, D. 2010. Preservation of freshwater fishes in the field (Chapter 22). In: Eymann, J., Degreef, J., Häuser, C., Monje, J. C., Samyn, Y. and van den Spiegel, D. (Eds.). Manual on field recording techniques and protocols for All Taxa Biodiversity Inventories and Monitoring. ABC Taxa, 8 (Part 2):587-631.

Neumann, H. 1953. Die physisch-geographischen Grundlagen der künstlichen Bewässerung des Iran und Irak. Wissenschaftliche Veröffentlichungen des Deutschen Instituts für Länderkunde, Leipzig, 12:4-46.

Neumann, J. 1993. Climatic changes in Europe and the Near East in the second millennium BC. Climatic Change, 23(3):231-245.

Neumann, J. and Sigrist, R. M. 1978. Harvest dates in ancient Mesopotamia as possible indicators of climatic variations. Climatic Change, 1(3):239-252; Addendum, pp. 253-256.

Neurasteh, N., Setorki, M., Tehranifard, A. and Moshfegh, A. 2017. Effects of salinity and plasma prolactin on chloride cells in the gill of *Chalcalburnus chalcoides*. Iranian Journal of Aquatic Animal Health, 3(2):11-21.

Neverian, H., Zahmatkesh, A., Zamani-Kyasajmahalleh, H. A. and Ghanaatparast, A. 2008. Determination of optimum level of vitamin premix for the diet of Caspian frisii kutum (advanced fry). Pajouhesh va Sazandegi, 79:166-174. In Farsi.

Neverian, H. A., Mostafazadeh, S. S. and Toluei Gilani, M. H. 2005. A study on various protein levels on growth indices (SR, WG, RGR, FCR and PER) of *Rutilus frisii kutum*, Kamenskii 1901 (advanced fry). Pajouhesh va Sazandegi, 18(3)(68):61-68. In Farsi.

Nevraev, A. F. 1929. Yuzhnoe poberezh'e Kaspiya (raion persidskikh vod) [South Caspian Coast

(Region of Persian Waters)]. Trudy Nauchnogo Instituta Rybnogo Khozyaistvo, 4:350-399.

Nezafat Rahimabadi, B., Khara, H. and Satari, M. 2008. Parasite infection of bream (*Abramis brama orientalis* Berg, 1949) in Aras Dam Lake. Journal of Biology Science, 2(3)(series no. 6):83-96. In Farsi.

Nezafatian, E. and Zadmajid, V. 2018. Effect of genistein on some seminal plasma biochemical and enzyme features in male gibel carp (*Carassius auratus gibelio*). Journal of Experimental Animal Biology, 6(3):105-116. In Farsi.

Nezameslami, A., Keivany, Y. and Dorofshan, S. 2013. Comparison of morphological characters of (Cyprinidae: *Garra rufa*) in Karkheh River basin. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 89 (abstract).

Nezami, B. Sh. and Khodaparast, S. H. 1996. Survey on organic matter accumulation in the Anzali Lagoon. Iranian Fisheries Scientific Journal, 5(2):1-10, 1. In Farsi.

Nezami, S., Sattari, M. and Khara, H. 2005. Parasites of some bonyfishes in Boojagh wetland from the southwest of the Caspian Sea. 12th EAFP International Conference on Diseases of Fish and Shellfish, Copenhagen (title).

Nezami, S. A., Savari, A., Sakari, M. and Alizadeh, M. 2000. National Report of Biodiversity in Caspian Coastal Zone. Research Department, Gilan Provincial Office, Department of the Environment Conservation, Iran (TACIS (Technical Assistance to the Commonwealth of Independent States, European Union), Caspian Environmental Programme). vi + 97 pp., 63 tables.

Nezami, Sh. A. and Khara, H. 2004. Species composition and abundance of fishes in Amirkelayeh Wetland. Iranian Scientific Fisheries Journal, 12(4):193-206. In Farsi.

Nezami Abadi, H. and Abdi, K. 2002. Review of diplostomiasis in fishes. Final report. Aquatic Health and Disease Office, Veterinary Organization of Iran. 44 pp. In Farsi.

Nezami Balouchi, Sh. A., Khara, H., Sabkara, J., Soltanzadeh, M. and Damshenas, Z. 2004. Study of tench (*Tinca tinca*) diet of Lahijan Amirkelayeh Wetland. Pajouhesh va Sazandegi, 16(4)(618):81-91. In Farsi.

Nezhad Moghadam, Sh., Imanpoor, M. R., Jafari, V. and Safari, R. 2018a. Effect of *Achillea millefolium* on mucosal immune response and immune related (TNF-alfa) gene expression in goldfish *Carassius auratus* (Linnaeus, 1758). Journal of Applied Ichthyological Research, 5(4):87-100. In Farsi.

Nezhad Moghadam, Sh., Imanpoor, M. R., Jafari, V. and Safari, R. 2018b. The effects of dietary supplementation of hydroalcoholic nettle extract (*Urtica dioica*) on gonads histological and sexual hormones in goldfish (*Carassius auratus*) broodstock. Journal of Animal Environment, 10(3):309-314. In Farsi.

Nezhad Moghadam, Sh. and Safari, R. 2016. The most frequent anticoagulant used in fish hematology in Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Niamir, A. 2001. Avan River. Moj-e Sabz; Social-Cultural Quarterly, (4):16-18. In Farsi (In English at www.netiran.com/Htdocs/WeeklyJournal/Social/wj00666.html).

Niani, A. and Khajeh-Rahimi, A-E. 2012. Effect of gelatin coating on fatty acid composition of grass carp (*Ctenopharyngodon idella*) during refrigerated-storage. World Journal of Fish and Marine Sciences, 4(5):462-466.

Niazi, A. D., Qasim, H. H. and Shalli, M. R. 1976. The comparative osteology of the osteocranium of Garra rufa (Heckel) & G. variabilis (Heckel). Bulletin of the Natural

History Research Center, Baghdad, 7(1):110-126.
Niazi, E. and Imanpoor, M. R. 2016. Effects of stocking density on spermatological parameters of goldfish (*Carassius auratus*) in off-season reproduction. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Niazie, E. H. N., Imanpoor, M., Taghizade, V. and Zadmajid, V. 2013. Effects of density stress on growth indices and survival rate of goldfish (*Carassius auratus*). Global Veterinaria, 10(3):365-371.
Niazie, E. H. N., Vajargah, M. F., Tarkhani, R., Vesaghi, M. J., Fouladi Sabet, A., Abbasi, F., Zamani, W., Bayati, M., Jafar Nodeh, A. and Hedayati, A. 2013. Surveying effects of fixation in formalin on the morphological characteristics of goldfish (*Carassius auratus*). Journal of Environmental Treatment Techniques, 2(2):28-30.
Nickho, M., Yosefian, M. and Safari, R. 2009. Effects of probiotic aqualase on growth and survival fingerling of wild common carp (*Cyprinus carpio*). Journal of Marine Science and Technology Research, 4(2):27-34. In Farsi.
Nico, L. G., Williams, J. D. and Jelks, H. L. 2005. Black Carp. Biological Synopsis and Risk Assessment of an Introduced Fish. American Fisheries Society Special Publication, 32:xx + 337 pp.
Nielsen, J. G. 1974. Fish Types in the Zoological Museum of Copenhagen. Zoological Museum, University of Copenhagen. 115 pp.
Niemiller, M. L., Bichuette, M. E., Chakrabarty, P., Fenolio, D. B., Gluesenkamp, A. G., Soares, D. and Zhan, Y. 2019. Cavefishes, pp. 227-236. In: White, W. B., Culver, D. C. and Pipan, T. (Eds.). Encyclopedia of Caves. 3rd Edition. Academic Press. 1250 pp.
Nijssen, H., van Tuijl, L. and Isbrücker, I. J. H. 1982. A catalogue of the type-specimens of recent fishes in the Institute of Taxonomic Zoology (Zoölogisch Museum), University of Amsterdam, The Netherlands. Verslagen en Technische Gegevens, Institut voor Taxonomische Zoölogie (Zoölogisch Museum), Universiteit van Amsterdam. 173 pp.
Nijssen, H., van Tuijl, L. and Isbrücker, I. J. H. 1993. Revised catalogue of the type specimens of recent fishes in the Institute of Taxonomic Zoology (Zoölogisch Museum), University of Amsterdam, The Netherlands. Bulletin Zoölogisch Museum Universiteit van Amsterdam, 13(18):211-262.
Nikbakht, M., Alboughobish, N. and Peyghan, R. 2007. Histological and histometrical studies of the gut associated lymphoid tissue (GAL T) in the intestinal bulb and main intestine of the *Barbus sharpeyi*. Shahid Chamran University Journal of Science, new series, 17, section B:106-116. In Farsi.
Nikghorban, S., Haghighi Karsidani, S. and Ghasemi, M. 2017. Primary cell culture from kidney of *Rutilus kutum*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Nikghorban, S., Haghighi Karsidani, S. and Ghasemi, M. 2019. Investigating the optimal conditions of primary cell culture of kidney tissue from Caspian white fish (*Rutilus kutum*) using explant method. Journal of Marine Biology, 11(1):79-90. In Farsi.
Nikgoo, O., Pazouki, J., Abbasi, K. and Shirali, S. 2018. Gastrointestinal parasite fauna of *Scardinius erythrophthalmus* (rudd) in Anzali Wetland. Iranian Journal of Veterinary Medicine, Supplementary Issue, 12(5):31.
Niki, N., Rahimi, R., Shaluei, F. and Nikookhah, F. 2016. Effect of nanosilver particles on bacterial gut flora in common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(1):123-131. In Farsi.

Niki Maleki, Z., Shabany, A. and Safari, R. 2020. Effects of singular or combined administration of prebiotic AMax© and *Lactobacillus casei* on growth related genes expression (IGFI and GH) in common carp (*Cyprinus carpio*). Journal of Animal Environment, 11(4):237-242. In Farsi.

Nikkhoo, M., Yosefian, M., Safari, R. and Vosoogh, A. R. 2010. Evaluation of growth factors and improvement of survival rate in common carp (*Cyprinus carpio*) fingerling feeding Aqualase (Thepax) in challenge with *Streptococcus* sp. Journal of Aquatic Animals and Fisheries, 1(1):73-82. In Farsi.

Nikmehr, N., Eagderi, S. and Jalali, P. 2016. Osteological description of *Barbus lacerta* Heckel, 1843 (Cyprinidae) from Tigris basin of Iran. Journal of Entomology and Zoology Studies, 4(4):473-477.

Nikmehr, N., Eagderi, S. and Jalali, P. 2017. Skeletal structure of Kura bleak, *Alburnus filippii* (Kessler, 1877), in South Caspian Sea basin. Nova Biologica Reperta, 4(1):55-64. In Farsi.

Niknam, E., Chamani, A. and Nourouzi, M. 2020. The water quality of Zayandeh-rood river with macrobenthos biodiversity indexes (*sic*) in fall 2017 to spring 2018. Journal of Applied Biology, 32(4):164-175. In Farsi.

Nikol'skii, A. M. 1897. Presmykayushchiyasya, amfibii i ryby, sobrannyya N. A. Zarudnym vostochnoi Persii [Reptiles, amphibians and fishes, collected by N. A. Zarudnyi in eastern Persia]. Ezhegodnik Zoologicheskogo Muzeya Imperatorskoi Akademii Nauk, St. Petersburg, 2:306-348, pl. XVII-XIX.

Nikol'skii, A. M. 1899. Presmykayushchiyasya, amfibii i ryby vtorogo puteshestviya N. A. Zarudnego v Persiyu v 1898 g [Reptiles, amphibians and fishes collected on the second expedition of N. A. Zarudnyi to Persia in 1898]. Ezhegodnik Zoologicheskago Muzeya Imperatorskoi Akademii Nauk, St. Petersburg, 4:375-417, pl. XX.

Nikol'skii, A. M. 1900. Novyi vid Discognathus iz Rossii (Pisces, Cyprinidae) [A new species of Discognathus from Russia]. Ezhegodnik Zoologicheskago Muzeya Imperatorskoi Akademii Nauk, St. Petersburg, 5:239-241. In Latin and Russian.

Nikol'skii, G. V. 1937. Materialy po sistematike bystryanok Alburnoides (Pisces, Cyprinidae) Srednei Asii [Material on the systematics of bystryanok Alburnoides (Pisces, Cyprinidae) of Central Asia. Pamyati Menzbira, Moskva (M. A. Menzbier Memorial Volume), 1937:306-316.

Nikol'skii, G. V. 1938. Ryby Tadzhikistana [Fishes of Tadzhikistan]. Izdatel'stvo Akademii Nauk SSSR, Leningrad. 217 pp.

Nikol'skii, G. V. 1945. Materialy po sistematike i obrazu zhizni Discognathichthys rossicus (Nik) (Pisces, Cyprinidae) [Material on the systematics and mode of life of Discognathichthys rossicus (Nik) (Pisces, Cyprinidae)]. Uchenye Zapiski Moskovskogo Gosudarstvennogo Universiteta, Novaya Seriya, 85:127-131.

Nikoo, M. and Falahatkar, B. 2008. Blood parameters in kutum (*Rutilus frisii kutum*) broodstocks at final maturation stage. Aquaculture Europe 2008, 15-18 September 2008, Krakow (title).

Nikoo, M. and Falahatkar, B. 2012. Physiological responses in wild broodstocks of the Caspian kutum (*Rutilus frisii kutum*) subjected to temperature stress. Journal of Applied Animal Welfare, 15(4):372-382.

Nikoo, M., Falahatkar, B., Alekhorshid, M., Haghi, B. N., Asadollahpour, A., Dangsareki, M. Z. and Langaroudi, H. F. 2010. Physiological stress responses in kutum *Rutilus frisii kutum*

subjected to captivity. International Aquatic Research, 2(1):55-60.

Nikoo, M., Falahatkar, B. and Rahmani, H. 2012. Blood parameters of southern Caspian kutum, *Rutilus frisii*. Journal of Applied Ichthyology, 28(2):293-295.

Nikoo, M., Rahmani, H., Ghomi, M. R., Asadollahpour, A., Zarei, M. and Bavand, E. 2010. Serum sex steroid hormones (testosterone, 17ß-estradiol and progesterone) of Caspian vimba, *Vimba vimba* and shemaya, *Alburnus chalcoides* during spawning period. Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):49-56. In Farsi.

Nikou, M., Saeidi, A. A., Yasemi, M., Jafari, A. and Alekhourshid, M. 2007. Changes in levels of cortisol, glucose and sex hormones during transportation of southern Caspian kutum (*Rutilus frisii kutum*) spawners. Iranian Scientific Fisheries Journal, 16(3):147-154. In Farsi.

Nikpay, M., Marashi, S. Z. and Moazedi, J. 1992. Survey of the biological features of *Barbus sharpeyi* and *B. grypus*. Iranian Fisheries Research and Training Organization Publications, Tehran. ix + 124 pp. In Farsi.

Nikravesh, S. 1997. An analysis of the status of water resources in Iran. Ab va Mohitezist (Water and Environment), Tehran, (1997, December), 25:44-51 (www.netiran.com/Htdocs/Clippings/DEconomy/971200XXDE01.html).

Nilsaz, M., Najafpour, N., Sabz-Alizadeh, S., Safikhani, H., Khodadadi, M. and Davoodi, F. 1993. Limnological study of Karun River (Gotvand to Bandeghir). Iranian Fisheries Research Organization, Tehran. 64 pp. In Farsi.

Nissan, E. and Zuckermann, G. 2015. Under other skies: Articulatory habits and cultural interference in the forms one's personal name takes abroad, pp. 269-287. In: Proceedings of the Third International Conference on Onomastics "Name and Naming". Conventional/Unconventional in Onomastics. Baia Mare, Romania, 1-3 September 2015.

Noaman, V., Chelongar, Y. and Shahmoradi, A. H. 2010. The first record of *Argulus foliacesus* (*sic*) (Crustacea: Branchiura) infestation on lionhead goldfish (*Carassius auratus*) in Iran. Iranian Journal of Parasitology, 5(2):71-76.

Nodeh, A. J. and Hoseini, S. M. Toxicity of potassium permanganate to Caspian kutum (*Rutilus frisii kutum*) at two sizes (1 and 3 g). Ecopersia, 1(3):291-298.

Nodehsharifi, S., Peyghambari, S. Y. and Gorgin, S. 2018. Survey and assessment of species diversity of *Cyprinus carpio*, *Rutilus frisii kutum* and *Rutilus rutilus* in Golestan province since 2006-2009. Journal of Animal Environment, 10(3):251-245. In Farsi.

Noel, E. 1944. "Qanats". Royal Central Asian Society Journal, 31(2):191-202.

Noghani, F., Ershad Langroodi, H., Jalali, S. H. and Koochekian Sabour, A. 2014. Effects of green tea extract and modified atmosphere packaging on the shelf life of silver carp (*Hypophthalmichthys molitrix*) minced at refrigerated storage. Journal of Fisheries, 8(2):71-80. In Farsi.

Noghani, F., Zarehgashti, Gh., Saiefzadeh, M., Moradi, Y., Khoshkhoo, Zh., Etemadian, Y. and Kamali, S. 2018. Comparison of qualitative characteristics of fish paste produced from minced kilka (*Clupeonella cultriventris*) and silver carp (*Hypophthalmichthys molitrix*). Iranian Scientific Fisheries Journal, 27(3):111-120. In Farsi.

Noorbakhsh, A. 1993a. Carp sport fishing in the north of Iran. Abzeeyan, Tehran, 4(3):24-30. In Farsi.

Noorbakhsh, A. 1993b. Reminding (*sic*) a river and its fishes (for the sport fishermen). Abzeeyan, Tehran, 4(4):16-19, II. In Farsi.

Noorbakhsh, H. 1993. Hamoon Lake and Zabol's fishermen. Abzeeyan, Tehran, 4(3):18-22. In

Farsi.
Noorbakhsh, H. 1995. Fish in Iranian poetry and idioms. Abzeeyan, Tehran, 5(9):21-24, III. In Farsi.
Noorbakhsh, J., Seyedmahalleh, E. S., Darvishi, G., Kootenaei, F. G. and Mehrdadi, N. 2014. An evaluation of water quality from Siahrod River, Haraz River and Babolrood River by NSFWQI Index. Current World Environment, 9(1):59-64.
Noorhosseini, S. A., Allahyari, M. S. and Bagherzadeh, F. 2014. Prioritizing benefits and limitations of integrated rice-fish farming based on fuzzy methods. Journal of Aquaculture Development, 8(1):73-82. In Farsi.
Noorhosseini-Niyaki, S. A. and Allahyari, M. S. 2012. A logistic regression analysis: Agro-technical factors impressible from fish farming in rice fields, north of Iran. International Journal of Agricultural Management and Development, 2(3):223-227.
Noorhosseini-Niyaki, S. A. and Bagherzadeh-Lakani, F. 2013. Production of fish varieties in paddy fields simultaneously (The case study in Iran). International Journal of Farming and Allied Sciences, 2 (15):464-469.
Noori, G., Jafari, V., Ghorbani, R. and Shaida, G. 2014. Feeding behavior and taste preferences of *Rutilus frisii kutum* to free amino acids. Journal of Fisheries (Iranian Journal of Natural Resources), 67(1):123-136. In Farsi.
Noori, M. G. 1966. Hydrology of surface water in Iran, pp. 199-211. In: Symposium on Hydrology and Water Resources Development held in Ankara, Turkey February 7 to 12, 1966, Central Treaty Organization, Ankara. 484 pp.
Noori, R., Berndtsson, R., Adamowski, J. F. and Rabiee Abyaneh, M. 2018. Temporal and depth variation of water quality due to thermal stratification in Karkheh Reservoir, Iran. Journal of Hydrology: Regional Studies, 19:279-286.
Noori, V., Hedayati, S. A., Hosseinifar, S. H., Bagheri, T. and Khaleghi, S. R. 2020. Effect of polyphenol pre-treatment on mucus immune indices of common carp *Cyprinus carpio* in exposed to silver nanoparticles. Journal of Animal Environment, 12(3):305-314. In Farsi.
Noorzaee, K., Zakipour Rahimabadi, E. and Alizadeh Doghikolaee, E. 2016. Proximate analysis and fatty acid composition of silver carp (*Hypophthalmichthys molitrix*) fillet after flash frying, frozen storage and deep-fat frying. Journal of Fisheries Science and Technology, 4(4):121-133. In Farsi.
Noroozi, M., Akrami, R. and Matinfar, A. 2006. Seminatural propagation and rearing of roach (*Rutilus rutilus caspicus*). Iranian Scientific Fisheries Journal, 15(3):165-170. In Farsi.
Norousta, R. and Mousavi-Sabet, H. 2013. Comparative characterization of blood cells and hematological parameters between the mature and immature Caspian Vimba, *Vimba vimba persa* (Teleostei, Cyprinidae). AACL Bioflux, 6(3):232-240.
Norouzi, H. and Rezaeimanesh, M. 2021. The use of BMWP and ASPT indices to assessment the water quality of Hashilan wetland (Kermanshah, Iran). Journal of Wetland Ecobiology, 12(1):67-64. In Farsi.
Norouzi, M. and Abbasi, K. 2015. Study of some biological parameters and reproduction of bitterling (*Rhodeus amarus*) in Sefidrood River, Guilan Province. Journal of Aquatic Ecology, Hormozgan University, 5(1):88-94. In Farsi.
Norouzi, M. and Bagheri Tavani, M. 2017. Analysis of four fresh fish’s species for determination of nutritive values. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 437-440. In Farsi.

Norouzi, N., Ghorbani, R., Hosseini, A., Hedayati, A. and Naddafi, R. 2021. Application of stable isotopes of carbon (13δC) and nitrogen (13δN) in assessment of Gorgan Bay fish dynamic in Golestan Province. Journal of Applied Ichthyological Research, 8(4):46-53. In Farsi.

Norouzi Elahbaksh Mahalle, M., Patimar, R., Abbasi, K., Golzariyanpour, K. and Bahalkeh, A. 2014. Comparative investigation of some growth characteristics of the bitterling (*Rhodeus amarus* Bloch, 1782) in aquatic ecosystems of Anzali lagoon and Siyahrood River. Journal of Applied Ichthyological Research, 2(1):11-22. In Farsi.

North, A. 1993. Saddam's water war. Geographical Magazine, 65(7):10-14.

Nosrati, M., Mirhasheminasab, S. F., Omidvar, S. and Zolfinezhad, K. 2017. Efficiency assessment of artificial spawning of *Alburnus chalcoides* by pituitary gland extract, ovaprim and HCG. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Nosrati, M., Zolfinezhad, K., Omidvar, S. and Mirhashemi Nasab, S. F. 2017. Comparative study on the growth rate of grass carp (*Chenopharyngodon* (*sic*) *idella*) in the feeding of *Azolla* and alfalfa. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Nosrati, M., Zolfinezhad, K., Omidvar, S. and Mirhasheminasab, S. F. 2017. Determination of artificial reproduction bio-technique of *Alburnus chalcoides* and its breeding until fingerling size. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Nosratpur, A., Shamloofar, M. and Akrami, R. 2013. Effect of prebiotic bio-mos (mannan oligosaccharide) on some growth indices, surviving and body composition of *Cyprinus carpio*. New Technologies in Aquaculture Development (Journal of Fisheries), 7(3):95-102. In Farsi.

Notash, S. 2012. Study on prevalence of *Argulus* in goldfishes (*Carassius auratus*) of east Azerbaijan province of Iran. Annals of Biological Research, 3(7):3444-3447.

Norusta, R., Mousavi, H., Moradkhani, Z., Homayuni, H., Marjani, M. and Khiabani, A. 2009. Study on clotting time of *Vimba vimba persa* in Caspian Sea. Asian Pacific Aquaculture 2009, 3-6 November 2009, Kuala Lumpur, Malaysia (abstract).

Noruz Fashkhami, M. R. and Khosroshahi, M. 1995. Karyology (chromosomal study) of the Caspian Sea kutum roach by white blood cells culture. Iranian Fisheries Scientific Journal, 4(1):64-71, 6. In Farsi.

Nouri, J., Gharagozlou, A., Nourifard, A. and Tehrani, S. M. 2005. Environmental impact assessment of the largest man made lake of Iran. Pakistan Journal of Biological Science, 8(12):1672-1677.

Nouri, J., Mirbagheri, S. A., Farrokhian, F., Jaafarzadeh, N. and Alesheikh, A. A. 2010. Water quality variability and eutrophic state in wet and dry years in wetlands of the semiarid and arid regions. Environmental Earth Sciences, 59(7):1397-1407.

Nourian, K., Baghshani, H. and Shahsavani, D. 2019. The effect of vitamin C on lead-induced plasma biochemical alterations in fish, *Cyprinus carpio*. Iranian Journal of Toxicology, 13(2):25-29.

Nouroozikoh, T., Ghasemzadeh, F., Ronaghi, H., Naser, A. and Ranjbar, N. 2017. Prevalence survey of *Ligulus* disease in *Rutilus rutilus* fish in Alborz dam in Mazandaran province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 363-367. In Farsi.

Nouroozikoh, T., Youssefi, M., Ghasemzadeh, F., Ranjbar, N. and Naser, A. 2017. Prevalence survey of infestation of fishes with *Eustrongylides excisus* in Alborz dam in Mazandaran province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 359-362. In Farsi.

Nouruz Fashkami, M. R., Pourkazemi, M. and Kalbassi, M. R. 2002. Progeny karyotyping of female *Rutilus frisii kutum* x male *Ctenopharyngodon idella* hybrid. Iranian Journal of Marine Sciences, 1(1):69-74. 79. In Farsi.

Nourzhad, G., Dehghani, H. and Shiroodi, M. B. 2013. The study of mucous cells in *Cyprinus carpio* reactions to physical and chemical factors. Journal of Aquatic Ecology, Hormozgan University, 2(3):14-25. In Farsi.

Noveirian, H. A. and Nasrollahzadeh, A. 2012. The effects of different levels of biogen probiotic additives on growth indices and body composition of juvenile common carp (*Cyprinus carpio* L.). Caspian Journal of Environmental Sciences, 10(1):115-121.

Noverian, H. A., Shabanipour, N., Khoshkholgh, M. R. and Hosseini, M. R. 2008. Effect of dietary digestible energy level on growth indices of kutum (*Rutilus frisii kutum* Kamenskii, 1901). Iranian Journal of Fisheries Sciences, 7(2 supplementary):205-214.

Novirian, H., Shaabanipour, N., Zaman Kiasaj Mahaleh, H. A. and Khadem, H. 2007. The effect of different level of lipids on growth index of Caspian Frisian kutum (fry stage) (*Rutilus frisii kutum* Kamenskii, 1901) utilizing semi-purified diets. Pajouhesh va Sazandegi, 20(3)(76):35-42. In Farsi.

Nowferesti, H., Asgardun, S. and Zare, P. 2014. Length-weight relationships of six freshwater cyprinid fishes of Iran. Journal of Applied Ichthyology, 30(5):169-170.

Nowrouzi, S. and Valavi, H. 2011. Effects of environmental factors on phytoplankton abundance and diversity in Kaftar Lake. Journal of Fisheries and Aquatic Science 6(2):130-140.

Nozarian, M., Javaheri Baboli, M. and Askary Sary, A. 2014. Body composition of bighead carp (*Aristichthys nobilis*) in different weight classes. International Journal of Biosciences, 5(4):88-93.

Nuhi, A and Khorasani, Y. 1981. Bacterial pollution indicators in the intestinal tract of various fish species living in Amir-Kolayeh Lagoon. Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten und Hygiene, 136(7):566-571.

Nümann, W. 1963. Report on the possibilities to manage the fishery in Karaj Reservoir. Report to the Game and Fish Department, Tehran. MS.

Nümann, W. 1964. Report on the possibilities of managing the fishery in Iranian rivers and reservoirs. Report to the Game and Fish Department, Tehran. MS.

Nümann, W. 1966. Limnologische Vorstudien zur fischereilichen Bewirtschaftung iranischer Stauseen und Fließgewässer. Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(5/6):433-478.

Nümann, W. 1969. Untersuchungen zur fischereilichen Bewirtschaftung iranischer Stauseen und Fließgewässer. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 17(2):705-713.

Nümann, W. and Hosseinzadeh, H. 1968. A study of some waters of Iran for increasing fish and fish culture. Report to the Game and Fish Department, Tehran. MS, 28 pp.

Nupky, M. 1996. Survey of the biology of *Barbus grypus* and *Barbus sharpeyi* in Khuzestan Province. Southern Iran Aquaculture Fishery Research Centre, Ahvaz. 120 pp. In Farsi.

Nur, G., Gül, S., Kaya, T. Ö. and Baysal, A. 2008. Concentration of cross, G and restriction endonuclears of the endemic *Acanthalburnus microlepis* (De Filippi, 1863) chromosomes

in Kura-Aras basin (Alu I, Nhe I, Hae III, Mbo I, Hinf I). Caucasus University Science Institute Journal, 1(2):1-10. In Turkish.

Nützel, W. 1975. The formation of the Arabian Gulf from 14000 B.C. I. II. The postglacial climatic optimum and the possible flooding of south Mesopotamia. Sumer, 31(1 & 2):101-110.

Nützel, W. 1976. The climate changes of Mesopotamia and bordering areas 14 000 to 2 000 B.C. Sumer, 32:11-25.

Nyrop, R. F. 1978. Iran, a country study. 3rd Edition, The American University, Washington, D.C. xxviii + 492 pp.

O

Oberlander, T. 1965. The Zagros Streams. A New Interpretation of Transverse Drainage in an Orogenic Zone. Syracuse Geographical Series, Syracuse University, New York, 1:xii + 168 pp.

Oberlander, T. M. 1968a. The origin of the Zagros defiles, pp. 195-211. In: Fisher, W. B. (Ed.). The Cambridge History of Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. xix + 784 pp.

Oberlander, T. M. 1968b. Hydrography, pp. 264-279. In: Fisher, W. B. (Ed.). The Cambridge History of Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. xix + 784 pp.

O'Donovan, E. 1882. The Merv Oasis: Travels and Adventures East of the Caspian During the Years 1879-81. Smith Elder, London, 2 volumes.

Oğuz, M. C., Amin, O. M., Heckmann, R. A., Tepe, Y., Johargholizadeh, G., Aslan, B. and Malek, M. 2012. The discovery of *Neoechinorhynchus zabensis* (Acanthocephala: Neoechinorhynchidae) from cyprinid fishes in Turkey and Iran, with special reference to new morphological features revealed by scanning electron microscopy. Turkish Journal of Zoology, 36(6):759-766.

Ojagh, S. M., Fatemi Rad, F., Kordjazi, M. and Jamshidi, A. 2016. Effects of different percentages of silver carp (*Hypophthalmichthys molitrix*) surimi and Indian white shrimp (*Penaeus indicus*) mince on improvement of shrimp nugget texture. Journal of Fisheries (Iranian Journal of Natural Resources), 69(3):285-297. In Farsi.

Ojagh, S. M., Kazimania, S., Jamshidi, A. and Shabanpour, B. 2013. The effect of different pre-frying temperatures on physical characteristics, amount of moisture and oil absorption in different parts of silver carp (*Hypophthalmichthys molitrix*) fish nuggets. Journal of Utilization and Cultivation of Aquatics, 2(4):43-59. In Farsi.

Ojagh, S. M., Rezaei, M. and Khoramgah, M. 2009. The investigation of nutritional composition and fatty acids in muscle of common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodon idella*). Iranian Journal of Food Science and Technology, 6(1):77-83. In Farsi.

Ojagh, S. M. and Shabanpour, B. 2013. Differentiation cultured carps using multivariate principal components analysis. Journal of Utilization and Cultivation of Aquatics, 2(1):69-84. In Farsi.

Ojagh, S. M., Shabanpour, B. and Jamshidi, A. 2013. The effect of different pre-fried temperatures on physical and chemical characteristics of silver carp fish (*Hypophthalmichthys molitrix*) nuggets. World Journal of Fish and Marine Sciences,

5(4):414-420.
Ojifard, A., Papri Moghaddam, M. J., Davoodi, R. and Husseini, H. 2016. Growth response and gill tissue damages of common carp (*Cyprinus carpio*) juveniles exposed to neem azal biopesticide (*Azadirachtin indica*) (*sic*). Journal of Fisheries Science and Technology, 5(3):51-64. In Farsi.
Okati, N., Esmaili Sari, A. and Ghasempouri, S. M. 2012. Hair mercury concentrations of lactating mothers and breastfed infants in Iran (fish consumption and mercury exposure). Biological Trace Element Research, 149(2):155-162.
Oladi, M., Badri, S., Nateghi Shahrokni, S. A. and Ghazilou, A. 2016. Observation of eye-attacking behaviour of koi *Cyprinus carpio* var. *koi* in a koi-goldfish polyculture system. Journal of Applied Animal Research, 45(1):215-216.
Olgunoglu, I. A., Olgunoglu, M. P. and Artar, E. 2011. Seasonal changes in biochemical composition and meat yield of shabut (*Barbus grypus*, Heckel 1843). Iranian Journal of Fisheries Sciences, 10(1):181-187.
Oliva, O. and Holčík, J. 1977. The hundredth anniversary of the birth of Academician L. S. Berg (1876-1950). Folia Zoologica, Brno, 26(1):93-95.
Oliva, O. and Šafránek, V. 1962. To systematics of the European bleak, Alburnus alburnus (Linnaeus). Věstník československé Společnosti zoologické, 26(4):324-328.
Oloomi, Y. 2001. Biological study on Gorganrood River. Iranian Scientific Fisheries Journal, 10(1):55-72. In Farsi.
Olyaei Seyedeh, R., Sharifpour, I. and Riahi Bakhtiari, A. 2014. In vitro study of histopathological effects of pyrene oil on composition on some vital organs of carp (*Cyprinus carpio*). Journal of Fisheries Science and Technology, 3(3):39-53. In Farsi.
Oman, G. 1984. L'ittionimia araba delle acque interne. II. Il bacino dell'Eufrate e del Tigri. L'Oriente Moderno, 64(3):95-108.
Omelchenko, D. 2016. Genetic variability of the genus *Alburnoides* in Azerbaijan. Diplomová práce, Přírodovědecká fakulta, Univerzita Karlova v Praze, 72 pp., 3 appendices.
Omidi, A., Mazloomi, S. and Farhangfar, H. 2009. Preservative effect of qanats water to reduce lead acetate toxicity (LC50 96h) on *Capoeta fusca*. Journal of Fisheries and Aquatic Science, 4(1):50-56.
Omidi, S. 2006. A survey on effects of aquaculture on the coastal waters of Bushehr (Helleh and Mond). Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Bushehr. http://en.ifro.ir (abstract).
Omidkar, H. 2001. A study of the fishes in subterranean channels (ghanats) around the city Sabzevar. Ph. D. Thesis, Veterinary Faculty, University of Tehran, Tehran.
Omidvar, S., Ghasemi, M., Omidvar, Z., Haghighi Karseydani, S. and Zolfinejad, K. 2016. The effect of *Rhabdovirus carpio* on hematological and immune parameters of Caspian kutum (*Rutilus frisii kutum*). Journal of Aquaculture Development, 10(4):27-38. In Farsi.
Omidvar, S., Ghasemi, M., Omidvar, Z., Haghighikarsidani, S., Faeed, M. and Nosrati, M. 2017. Liver enzyme activity changes in fingerling whitefish challenged to *Rhabdovirus carpio*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Omidvar, S., Mirhashemi Nasab, S. F., Ghasemi, M., Omidvar, Z., Faeed, M., Zolfinezhad, K. and Khedmati, K. 2017. Monitoring of eye parasite, *Diplostomum spathaceum*, in *Abramis brama* which have been introduced to the Anzali wetland. The Fifth Iranian

Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Omidzahir, Sh., Alijantabar, M., Kardel, F. and Mazandarani, M. 2017. Assessment of iron concentration in skin and muscle of common carp (*Cyprinus carpio*) following exposure to iron oxide nanoparticles. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Omidzahir, Sh., Alijantabar Bayi, M., Kardel, F. and Mazandarani, M. 2019. Effects of iron oxide nano-particles on the intestinal tissue of common carp, *Cyprinus carpio*. Iranian Journal of Toxicology, 13(3):33-38.

Omidzahir, Sh., Ebrahimzadeh Mousavi, H., Shayan, P., Ebrahimzadeh Abkooh, E. and Mahmoodzadeh, H. 2016. Morphometric and molecular analysis of *Gyrodactylus kobayashi* in *Carassius auratus* (Linnaeus, 1758). Journal of Veterinary Research, 70(4):425-432. In Farsi.

Oosterbroek, P. and Arntzen, J. W. 1992. Area-cladograms of circum-Mediterranean taxa in relation to Mediterranean palaeogeography. Journal of Biogeography, 19(1):3-20.

Opuszynski, K. and Shireman, J. V. 1995. Herbivorous fishes. Culture and Use for Weed Management. CRC Press, Boca Raton. 223 pp.

Orian, Sh., Seifabady, J. and Jamily, Sh. 1993. Influence of salinity upon growth rate and tolerance of Barbus sharpeyi. Iranian Fisheries Bulletin, (2):45-55, 5-6. In Farsi.

Oryan, S., Parivar, K. and Rasekhi, K. 2005. The effects of baclofen (GABA-B receptor agonist) administration alone and accompanied with LRH-A and metoclopramid on GTH-I release in carp (*Cyprinus carpio* L.). Journal of the Faculty of Veterinary Medicine, University of Tehran, 60(3):265-271. In Farsi.

Oryan, S., Vosoughi, Gh. R. and Zarrin Kamar, H. 1998. The role of some physiological changes in the feeding of Rutilus frisii kutums (*sic*) (within Anzali port province). Journal of the Faculty of Veterinary Medicine, University of Tehran, 53(1-2):14-18.

Ostovari, H., Shajiee, H. and Gholi Kami, H. 2011. Some morphometric and meristic study of *Capoeta fusca* Nikolskii, 1897 in qanats of Ferdows City (Southern Khorasan). Journal of Aquatic Animals and Fisheries, 2(6):1-8. In Farsi.

Ostovari, H., Shajiee, H. and Kami, G. H. 2012. The study of biological and biosystematical characteristics of *Capoeta fusca* in southern Khorasan. Journal of Animal Biology, 4(3):1-9. In Farsi.

Otero, O. 2001. The oldest-known cyprinid fish of the Afro-Arabic Plate, and its paleobiogeographical implications. Journal of Vertebrate Paleontology, 21(2):386-388.

Ouraji, H., Jani Khalili, Kh., Ebrahimi, Gh. and Jafarpour, S. A. 2011. Determination of the optimum transfer time of kutum (*Rutilus frisii kutum*) larvae from live food to artificial dry feed. Aquaculture International, 19(4):683-691.

Ouraji, H., Sudagar, M., Jani Khalili, K., Dadashi, F., Keramat, A. and Kamali, K. 2015. Effect of different levels of Azolla meal on growth performance and digestibility of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 23(4):97-105. In Farsi.

Ouseley, W. 1819-1823. Travels in various countries of the East; more particularly Persia. A work wherein the Author has described, as far as his own Observations extended, the State of those Countries in 1810, 1811, and 1812; and has endeavoured to illustrate many subjects of Antiquarian Research, History, Geography, Philology and Miscellaneous Literature, with extracts from rare and valuable Oriental Manuscripts. Rodwell and Martin, London. Volume I(1819):455 pp., plates, maps; volume II(1821):544 pp., plates,

maps; volume III(1823):600 pp., plates, maps.
Oveysi, M., Jamili, Sh., Behdani, M., Mashinchian Moradi, A. and Sharifpoor, E. 2017. Analysis of vitellogenin gene structure in Caspian roach, *Rutilus caspicus* (Pisces: Cyprinidae) during exposure to atrazine. Caspian Journal of Environmental Sciences, 15(4):309-319.
Owfi, F. 2016. Environmental and ecological studies in northern Alborz aimed at developing the fisheries resources. Iranian Fisheries Science Research Institute, Tehran. 58 pp. In Farsi.
Owfi, F. and Rabaniha, M. 2005. Taxonomic studying, classification improvement and completion of Osteichthyes list of National Museum for Natural History (MMTT). Second Conference on Natural History Museum in Iran, Ferdowsi University of Mashhad, p. 73 (abstract).
Owfi, F. and Rabbaniha, M. 2014. Taxonomic review of marine bony fishes of Iranian National Museum of Natural History MMTT (Persian Gulf, Oman Sea, Caspian Sea). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Oymak, S. A. 2000. Atatürk Baraj Golü'nde Yasayan *Chondrostoma regium* (Heckel, 1843)'un Büyüme Ozellikleri (The growth characteristics of *Chondrostoma regium* (Heckel, 1843) in Atatürk Dam Lake (Turkey). Turkish Journal of Zoology, 24(supplement):41-50.
Oymak, S. A., Dogan, N. and Uysal, E. 2008. Age, growth and reproduction of the shabut *Barbus grypus* (Cyprinidae) in Atatürk Dam Lake (Euphrates River), Turkey. Cybium, 32(2):145-152.
Özcan, G. 2007. Distribution of non-indigenous fish species, Prussian carp *Carassius gibelio* (Bloch, 1782) in the Turkish freshwater systems. Pakistan Journal of Biological Sciences, 10(23):4241-4245.
Özdemir, N. and Şen, D. 1986. Age determination by scale, vertebra and operculum of Leuciscus cephalus orientalis (Nordmann, 1840) in the Euphrates. Journal of Fırat University, Elazığ, 1(1):101-111.
Özdilek, Ş. Y. and Jones, R. I. 2014. The diet composition and trophic position of introduced Prussian carp *Carassius gibelio* (Bloch, 1782) and native fish species in a Turkish river. Turkish Journal of Fisheries and Aquatic Sciences, 14(3):769-776.
Özgür, M. E., Akbulut, A. and Demirsoy, A. 2016. Characterization of the embryonic and larval development of wild pike-barb (*Luciobarbus esocinus*) biological parameters, and the possibility of breeding. Israeli Journal of Aquaculture - Bamidgeh, 68:10 pp.
Özpolat, E., Patır, B., Guran, H. Ş. and Gul, M. R. 2014. Effect of vacuum-packing method on the shelf-life of *Capoeta umbla* sausages. Iranian Journal of Fisheries Sciences, 13(1):178-184.
Öztaş, H. 1988. Müceldi Suyu'nda (Doğu Anadolu) Yaşayan Tatlısu Kefali [*Leuciscus cephalus* (L., 1758)] Populasyonunda Mevsimsel Kondüsyon Faktörü Değişimleri Üzerine Araştırmalar (Studies on the seasonal condition factor variations of chub (*Leuciscus cephalus* (L., 1758) population in Müceldi stream in east Anatolien (*sic*)). Doğa Türk Zooloji Dergisi, 12(3):256-261.
Öztaş, H. 1989. A study the reproduction biology of chub (*Leuciscus cephalus* L., 1758)) in Müceldi stream in east Anatolien (*sic*). Doğa Türk Veterinerlik Hayvancılık Dergisi, 13(2):171-179.
Öztaş, H. and Solak, K. 1988. Müceldi Suyu'nda (Doğu Anadolu) Yaşayan Tatlısu Kefalinin [*Leuciscus Cephalus* (*sic*) (L., 1758)] Büyüme Özellikleri ve Eşem Oranları (The growth and sexual rates of chub [*Leuciscus cephalus* (L., 1758)] living in the Müceldi stream in

east Anatolien (*sic*)). Doğa Türk Zooloji Dergisi, 12(3):262-271.

Özuluğ, M. and Freyhof, J. 2008. *Capoeta turani*, a new species of barbel from River Seyhan, Turkey (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 19(4):289-296.

Özuluğ, M. and Freyhof, J. 2011. Revision of the genus *Squalius* in Western and Central Anatolia, with description of four new species (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 22(2):107-148.

P

PADECO Co. Ltd. 2002. Ecotoxicological study: investigation into toxic contaminant accumulation and related pathology in the Caspian sturgeon, seal and bony fish (ECOTOX Study). Final Workshop Report, Baku, Azerbaijan, 28-29 March 2002, The World Bank. 17 pp.

Paepke, H.-.J. 1999. Bloch's Fish Collection in the Museum für Naturkunde der Humboldt Universität zu Berlin. An Illustrated Catalog and Historical Account. A. R. G. Gantner Verlag KG, Ruggell, Liechtenstein. 216 pp., 32 pls.

Paghe, E., Maghsoudlu, T. and Abdoli, A. 2005. Study of age and growth of Caspian roach (*Rutilus rutilus caspicus*) in Gomishan Wetland (southeastern Caspian Sea). Journal of Agricultural Sciences and Natural Resources, 11(4):151-162. In Farsi.

Pagheh, A. and Maghsoodlu, T. 2000. A study of age. growth and reproduction of roach, *Rutilus rutilus caspicus,* in Gomishan Wetland. B.Sc. Project, University of Gorgan, Gorgan. In Farsi.

Pahlavani, P., Vatandoust, S. and Ghorbani, R. 2015. Survey of some aspects of the reproductive biology siah mahi (*Capoeta capoeta gracilis*) in Babol River. Journal of Animal Environment, 6(4):209-219. In Farsi.

Paighambari, S., Gharasheh, M. H. and Jafari, V. 2013. Effect of electrofishing stress on hematological parameters of wild carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 2(1):85-95. In Farsi.

Paighambari, S. Y., Daliri, M. and Kia-alvandi, S. 2013. The catch composition of the beach seine fishery in southeast of the Caspian Sea (case study: Golestan Province). Journal of Aquatic Ecology, Hormozgan University, 2(4):18-28. In Farsi.

Paighambari, S. Y., Mohammadi, M. G., Raeisi, H. and Pouladi, M. 2020. Seasonal comparison of catch composition, biodiversity and length-weight relationships of fish fauna of Doroudzan Dam, Fars Province, Iran. Journal of Wildlife and Biodiversity, 4(1):18-28.

Paighambari, S. Y., Moradinasab, A., Raeisi, H., Daliri, M., Parsa, M. and Kamrani, E. 2014. Effect of colour of fyke-net on CPUE and species composition of fishes in Anzali Wetland. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Paknejad, H., Haji Moradlou, A., Rastegari, S., Hosseini, M. and Azadi, H. 2020. The effect of different levels of mint powder on the expression of genes involved in growth (IGF, GH) and some blood and biochemical factors of word fish (*Rutilus caspius*). Journal of Aquatic Ecology, Hormozgan University, 8(4):114-120. In Farsi.

Pakzad, M., Chamani, A. and Besalatpour, A. A. 2017. Physiochemical and morphological effects on cadmium accumulation in common carp (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 11(1):71-82. In Farsi.

Palandačić, A., Naseka, A., Ramler, D. and Ahnelt, H. 2017. Contrasting morphology with molecular data: an approach to revision of species complexes based on the example of European *Phoxinus* (Cyprinidae). BMC Evolutionary Biology, 17:184.

Pallas, P. S. 1771. Reise durch verschiedene Provinzen des russischen Reiches, 1768 und 1769sten Jahre. St. Petersburg. Volume 1.

Pallas, P. S. 1776. Reise durch verschiedene Provinzen des russischen Reiches, 1768 und 1769sten Jahre. St. Petersburg. Volume 3.

Pallas, P. S. 1787. Piscium novae species descriptio. Nova Acta Academiae Petropolitanae, 1 (Hist.):258.

Pallas, P. S. 1814. Zoographia Rosso-Asiatica. Vol. 3, Animalia Monocardia seu Frigida Sanguinis Imperii Rosso-Asiatici. Petropolis, 428 pp., + atlas.

Panahandae, M., Mansori, N., Khorasani, N., Karbasi, A. and Riyazi, B. 2013. Estimate of exposure and potential hazard to consumption of *Esox lucius*, *Cyprinus carpio*, *Chalcalburnus chaleoide* (*sic*) containing lead, cadmium and chromium in the Indian (*sic*) bordering of Anzali Lagoon. Journal of Wetland Ecobiology, 5(16):83-90. In Farsi.

Panahandeh, M., Mansouri, N., Khorasani, N., Karbassi, A. and Riazi, B**.** 2014. A study of heavy metals concentration in water, sediments and *Cyprinus carpio*, *Abramis brama*, *Carassius carassius* species from Anzali Wetland. International Journal of Biosciences, 4(11):51-59.

Panahandi, M. and Morovati, M. 2018. Risk of heavy metals (copper, zinc, cadmium and chromium) on the life of fish in Anzali Wetland ecosystem. Journal of Animal Biology, 31(3):23-39. In Farsi.

Panahi, A., Alijani, B. and Mohammadi, H. 2010. The effect of the land use/cover changes on the floods of the Madarsu basin of northeastern Iran. Journal of Water Resource and Protection, 2(4):373-379.

Panahi Sahebi, H., Esmaeili Fereidouni, A., Imanpour, M. R., Taheri Mirghaed, A., Barari, A. and Kavianpour, M. 2019. Effects of dietary inclusion of prebiotic immunowall and probiotic primalac on growth indices, survival, body composition, and blood biochemical parameters in the Caspian Sea carp, *Cyprinus carpio*, fingerlings. Journal of Veterinary Research, 74(1):45-53. In Farsi.

Panahinia, S. M., Bozorgnia, A., Barzegar, M. and Saberi, S. E. 2020. Prevalence, and distribution pattern of nematode parasites of some fish species of Haraz, Babolroud, Tajan and Talar rivers in Mazandaran Province. New Technologies in Aquaculture Development (Journal of Fisheries), 14(3):12-22. In Farsi.

Panjvini, F., Abarghuei, S., Khara, H. and Parashkoh, H. M. 2016. Parasitic infection alters haematology and immunity parameters of common carp, *Cyprinus carpio*, Linnaeus, 1758. Journal of Parasitic Diseases, 40(4):1540-1543.

Papahn, A. A., Peyghan, R. and Modaresi, Sh. 2005. Electrocardiograph changes in anesthesia with ketamine in grass carp. Journal of Veterinary Research, 60(1):59-64. In Farsi.

Papahn, F., Rezaei, M., Eskandari, Gh. and Rasekhi, A. 2013. The survey of fish population Hoor-Al Azim Marsh. Journal of Wetland Ecobiology, 5(16):33-40. In Farsi.

Papahn, F., Valinejad Zavaregh, A. A. and Hoghooghirad, N. 2004. Identification of monogeneans and their population density impact on *Barbus grypus* and *B. sharpeyi* in Karoon River in Ahwaz. Journal of the Faculty of Veterinary Medicine, 59(3):283-288. In Farsi.

Papi, Sh., Haji Moradlou A. A. and Ghorbani, R. 2010. Effects of various concentrations and

times of salt bath on skin wound healing process in carp, *Cyprinus carpio*. Journal of Fisheries, 4(2):89-96. In Farsi.

Parafkandeh Haghighi, F. 2006. Stock discrimination of *Rutilus rutilus* by using otoliths. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture. http://en.ifro.ir (abstract).

Parafkandeh Haghighi, F. 2016. Study forming of growth rings in the Caspian bony fishes (Step 1: Common carp *Cyprinus carpio* Linnaeus, 1758. Iranian Fisheries Science Research Institute, Tehran. 38 pp. In Farsi.

Parafkandeh Haghighi, F. and Rezvani, S. 2005. Discrimination of populations of Caspian roach (*Rutilus rutilus*) using trace element content in otoliths. Iranian Scientific Fisheries Journal, 14(3):19-36. In Farsi.

Paray, B. A., Hoseini, S. M., Hoseinifar, S. H. and Van Doan, H. 2020. Effects of dietary oak (*Quercus castaneifolia*) leaf extract on growth, antioxidant, and immune characteristics and responses to crowding stress in common carp (*Cyprinus carpio*). Aquaculture, 524:735276.

Parin, N. V. 2001. An annotated catalog of fishlike vertebrates and fishes of the seas of Russia and adjacent countries. Part 1. Orders Myxiniformes - Gasterosteiformes. Journal of Ichthyology, 41(supplement 1):S51-S131.

Parin, N. V., Evseenko, S. A. and Vasil’eva, E. D. 2014. Fishes of Russian Seas. Annotated Catalogue. KMK Scientific Press Ltd., Moscow. 733 pp. (Archives of the Zoological Museum of Moscow Lomonosov State University, 53).

Parivar, K., Behzadi, S. and Razavi, B. 1993. The chronological development of embryo in Rutilus frisii kutum (Kamensky). Iranian Fisheries Bulletin, (1):3-24, 3-4.In Farsi.

Parmaksiz, A. 2018. Genetic variation in *Cyprinion macrostomus* Heckel, 1843 populations as revealed by partial COI sequences of mitochondrial DNA. Applied Ecology and Environmental Research, 16(2):1899-1907.

Parmaksiz, A. 2019. Population genetic diversity of yellow barbell (*sic*) (*Carasobarbus luteus*) from Kueik, Euphrates and Tigris rivers based on mitochondrial DNA D-loop sequences. Turkish Journal of Fisheries and Aquatic Sciences, 20(1):79-86.

Parmaksız, A. 2021. Determination of genetic variation by using mitochondrial DNA cyt b sequences in populations of *Carasobarbus luteus* (Cyprinidae). Aquatic Research, 4(4):313-320.

Parmaksiz, A. and Eksi, E. 2017. Genetic diversity of the cyprinid fish *Capoeta trutta* (Heckel, 1843) populations from Euphrates and Tigris rivers in Turkey based on mtDNA COI sequences. Indian Journal of Fisheries, 64(1):18-22.

Parmaksız, A. and Eskici, H. K. 2018. Genetic variation of yellow barbell (*sic*) (*Carasobarbus luteus* (Heckel, 1843)) from four populations using mitochondrial DNA COI gene sequences. Applied Ecology and Environmental Research, 16(2):1673-1682.

Parmaksız, A. and Şeker, Ö. 2018. Genetic diversity of the endemic species shabbout (*Arabibarbus grypus* (Heckel, 1843)) based on partial cytochrome b sequences of mitochondrial DNA. Aquatic Research, 1(3):103-109.

Parsa, A. and Bahramian, S. 2011. Survey on some biometrical parameters of *Chalcalburnus mossulensis* fish infection by *Ligula intestinalis* (Cestoda). Veterinary Clinical Pathology (Veterinary Journal Tabriz), 5(2)(18):1211-1216. In Farsi.

Parsa, A., Mojazi Amiri, B. and Sharifpour, I. 2010. Histopathological survey of *Chalcalburnus mossulensis* gonads infected by *Ligula intestinalis* (Cestoda) in Gheshlagh Dam of

Sanandaj. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 4(11):11-19. In Farsi.

Parsa, A., Rahanande, M., Ali Mohammadzadeh, P. and Zamani Dadaneh, S. 2012. The epidemiological study of ligulosis through the population of *Alburnus mossulensis* in the Vahdat Dam of Kurdestan. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 6(2):59-63. In Farsi.

Parsa Khanghah, A., Mojazi Amiri, B., Sharifpour, I., Jalali Jafari, B. and Motalebi, A. A. 2011. Gonads tissue changes of *Chalcalburnus mossulensis* (Heckel, 1843) infected by *Ligula intestinalis* (Cestoda). Iranian Journal of Fisheries Sciences, 10(1):85-94.

Parsi, B., Askari Hesni, M., Zangiabadi, S. and Tahami, M. S. 2014. Identification and ecological study habitat of the *Capoeta damascina* (Cyprinidae) in Kouhbanan, Kerman Province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Parsiani, M., Yahyavi, M., Sajadi, M. M., Karimabadi, A. and Mohammadzadeh, H. 2010. The study of combination effects of gonadarelin and prostaglandine (PGF2α) hormone on the semi-artificial breeding in gold fish (*Carassius auratus*). Journal of Aquatic Animals and Fisheries, 1(2):1-10. In Farsi.

Partow, H. 2001. The Mesopotamian Marshlands: Demise of an Ecosystem. Early Warning and Assessment Technical Report, Division of Early Warning and Assessment, United Nations Environment Programme, Nairobi, UNEP/DEWA/TR.01-3 Rev.1:x + 47 pp. (www.grid.unep.ch/activities/sustainable/tigris/marshlands).

Parvandi, S., Abdoli, A. and Hashemi Seyed, H. 2016. Biological assessment Jajrood River using the macrobenthos community structure. Journal of Aquatic Ecology, Hormozgan University, 6(1):20-32. In Farsi.

Patimar R. 2007. None-indigenous (*sic*) fishes of Alma-Gol, Adji-Gol and Ala-Gol Wetlands (Golestan Province): implications for conservation and management programs of wetlands. Environmental Sciences, 4(3):1-8. In Farsi.

Patimar R. 2008. Fish species diversity in the lakes of Alma-Gol, Adji-Gol, and Ala-Gol, Golestan Province, northern Iran. Journal of Ichthyology, 48(10):911-917.

Patimar, R. 2009. Some biological parameters of silver crucian carp, *Carassius auratus*, in the international wetlands of Alma-Gol and Ala-Gol (Golestan Province, Iran). Iranian Journal of Fisheries Sciences, 8(2):163-174.

Patimar, R. and Abdoli, A. 2009. Fish biodiversity in Zarrin-gol River (East Alborz Mountain-Golestan Province). Journal of Agricultural Sciences and Natural Resources, 16(4):72-81. In Farsi.

Patimar, R. and Abdoli, A. 2010. Status of 5 exotic fish species in the South Caspian basin: implications for conservation. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).

Patimar R., Abdoli A., Hasanzadeh Kiabi, B., Alahyari, S. and Naderi Jeloudar, M. 2009. Fish species diversity of the coastal areas in Gomishan Wetland. Journal of Agricultural Sciences and Natural Resources, 16(Special Issue 1-A). In Farsi.

Patimar R., Abdoli A. and Kiabi, B. H. 2008. Biological characteristics of the introduced sawbelly, *Hemiculter leucisculus* (Basilewski, 1855), in three wetlands of northern Iran: Alma-Gol, Adji-Gol and Ala-Gol. Journal of Applied Ichthyology, 24(5):617-620.

Patimar, R. and Baensaf, S. 2012. Morphology, growth and reproduction of the non-indigenous topmouth gudgeon *Pseudorasbora parva* (Temminck et Schlegel, 1846) in the wetland of

Alma-Gol, northern Iran. Russian Journal of Biological Invasions, 3(1):71-75.

Patimar, R., Chalanchi, M. G., Chamanara, V. and Naderi, L. 2010. Some life history aspects of *Garra rufa* (Heckel, 1843) in the Kangir River, western Iran. Zoology in the Middle East, 51(1):57-66.

Patimar, R. and Dowlati, F. 2007. Investigation on age, growth and reproduction of riffle minnow *Alburnoides bipunctatus* (Bloch, 1782) in Zarrin-Gol River, east Alborz Mountain. Journal of Fisheries, 1(1):55-62. In Farsi.

Patimar, R., Ezzati, M. and Sarli, J. 2010. Life-history aspects of Caspian shemaya *Alburnus chalcoides* in two south Caspian rivers (Siahroud and Gorganroud). Turkish Journal of Fisheries and Aquatic Sciences, 10(2):277-285.

Patimar, R. and Farzi, S. 2011. Life history and other biological traits of the trout barb *Capoeta trutta* in the River Meymeh (western Iran). Folia Zoologica, Brno, 60(2):153-158.

Patimar, R., Hajili Davaji, A-J. and Jorjani, A. 2011. Life history of the Lenkoran *Capoeta Capoeta Gracilis* (Keyserling, 1981) (*sic*) in the Atrak River, northern Iran. Journal of Life Sciences, 5(5):369-375.

Patimar, R., Hosseini, S. H., Azimi, A. and Hajidun, H. A. 2007. Age structure of migratory kutum (*Rutilus frisii kutum* Kamensky, 1901) into Tonekabon River. Journal of Fisheries, 1(3):9-18. In Farsi.

Patimar, R., Igdrei, S., Hamid-Sales, B. and Ba-Ensaf, S. 2002a. Two alien species in the International Wetlands, Alma-Gol, Adji-Gol and Ala-Gol, of Golestan Province, Iran. World Congress on Aquatic Protected Areas, Cairns, 14-17 August 2002 (abstract).

Patimar, R., Igdrei, S., Hamid-Sales, B. and Ba-Ensaf, S. 2002b. Two alien species in the International Wetlands, Alma-Gol, Adji-Gol and Ala-Gol, of Golestan Province, Iran (a new record). Australian Society for Fishery Biology Annual Conference, 2002 (abstract).

Patimar, R., Kiaalvandi, S. and Faramarzi, M. 2012. Length-weight relationship of three fish species of Cyprinidae in Tajan River, Iran. World Journal of Fish and Marine Sciences, 4(5):509-511.

Patimar, R. and Kiabi, B. H. 2005. Alien fish species, implications for conservation and management programmes; a case study of wetlands of Golestan province (north of Iran). Borok II, International Workshop, Invasions of Alien Species in Holarctic, 27 September-1 October 2005, Borok (abstract).

Patimar, R., Kiabi, B., Salnikov, N. and Kamali, A. G. 2005. Univariate and multivariate analysis of the morphological variability among roach populations (*Rutilus rutilus caspicus*) from Gomishan, Adji-Gol and Alma-Gol wetlands. Journal of Agricultural Sciences and Natural Resources, 11(4):163-174. In Farsi.

Patimar, R. and Kiabi, B. H. 2003. Fish species diversity in the International Wetlands, Alma-Gol, Adji-Gol, and Ala-Gol of Golestan Province, North of Iran. 3rd Annual Conference 2003 Ecology Society, Halle/Saale, Germany, September 8 - 12, 2003 (title).

Patimar, R. and Kiabi, B. H. 2004a. Fish species diversity in the international wetlands, Alma-Gol, Adji-Gol and Ala-Gol, of Golestan Province, north of Iran. Societas Internationalis Limnologiae (SIL) XXIX Congress, Lahti, Finland, 8-14 August 2004 (title).

Patimar, R. and Kiabi, B. H. 2004b. Fish species diversity in the international wetlands, Alma-Gol, Adji-Gol and Ala-Gol, of Golestan Province, north of Iran. The XIXth International Congress of Zoology, August 23-27, 2004, Beijing (title).

Patimar, R. and Mohammadzadeh, B. 2011. On the biological characteristics of *Capoeta fusca* Nikolskii, 1897 in eastern Iran. Journal of Applied Ichthyology, 27(3):873-878.

Patimar, R., Nadjafypour, E., Yaghouby, M. and Nadjafy, M. 2010. Reproduction characteristics of a stunted population of rudd, *Scardinius erythrophthalmus* (Linnaeus, 1758) living in the Anzali Lagoon (the southwest Caspian Sea, Iran). Journal of Ichthyology, 50(11):1060-1065.

Patimar, R. and Nasri, M. 2007. Investigation on age structure and growth of lotak *Cyprinion macrostomum* (Heckel, 1843) in Seimareh River, Ilam Province. Journal of Agricultural Sciences and Natural Resources, 2(5):12-22. In Farsi.

Patimar, R., Ownagh, E., Jafari, N. and Hosseini, M. 2009. Intrabasin variation in allometry coefficients of Lenkoran *Capoeta capoeta gracilis* (Keyserling, 1861) in the Gorganroud basin, southeast Caspian Sea. Journal of Applied Ichthyology, 25(6):776-778.

Patimar, R. and Safari, S. 2010. Description of the biology of Caspian vimba, *Vimba vimba* (Linnaeus, 1758), in Gorgan Bay-Miankaleh Wildlife Refuge (southeast Caspian Sea). Chinese Journal of Oceanology and Limnology, 28(6):1173-1179.

Patimar, R., Seifi, T., Farahi, A. and Ezzati, M. 2010. Life history pattern of the bitterling *Rhodeus amarus* (Bloch, 1782) in Siahroud River (southern Caspian Sea-Iran). Ecohydrology and Hydrobiology, 10(1):87-95.

Patimar, R., Zare, M. and Hesam, M. 2012. On the life history of the spirlin *Alburnoides bipunctatus* (Bloch, 1782) in the qanat of Uzineh, northern Iran. Turkish Journal of Zoology, 36(3):383-393.

Pavlinov, I. Ya. and Borissenko, A. V. (Eds.). 2001. Types of Vertebrates in the Zoological Museum of Moscow University. Sbornik Trudov Zoologicheskogo Muzeya MGU (Archives of the Zoological Museum of Moscow State University), 41:1-250 (In Russian and English).

Pavlov, D. S., Reshetnikov, Yu. S., Shatunovskiy, M. I. and Shilin, N. I. 1985. Rare and disappearing fishes in the USSR and the principles of their inclusion in the "Red Book". Journal of Ichthyology, 25(1):88-99.

Pavlov, D. S., Savvaitova, K. A., Sokolov, L. I. and Alekseev, S.S. 1994. Redkie i Ischezayushchie Zhivotnye. Ryby [Rare and vanishing animals. Fishes]. Vysshaya Shkola, Moskva. 334 pp., 16 pls.

Pavlov, D. S. and Vilenkin, B. Ya. 1989. Present state of the environment, biota, and fisheries of the Volga River, pp. 504-514. In: Dodge, D. P. (Ed.). Proceedings of the International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences, 106:v + 629 pp.

Pavlovskaya, L. P. and Zhaldasova, I. M. 1991. Anthropogenic changes in the fish fauna of the Amu Darya River (based on data from sampling drift of eggs and larvae). Journal of Ichthyology, 31(8):585-595.

Payanda Langarudi, M. 1987. Farhang-e Gil o Deylam: Farsi ba Gilaki. Tehran.

Payandeh. K. and Velayatzadeh, M. 2019. Determining of the heavy metals cobalt, chromium, manganese, selenium and molybdenum in sediments of Hooralazim wetland in Khuzestan province using pollution indices. Journal of Wetland Ecobiology, 11(2):83-96. In Farsi.

Paydar Fard, A., Mohammad Zadeh, M. and Bolkhari Ghehi, H. 2019. Analysis of Quranic counter-discourse in two miniatures of Joseph in prison and Jonah and the fish from Shah Tahmasebi's Falnama. Bagh-e Nazar, 15(69):31-40. In English and Farsi.

Paye, A. I. 2016. Asian upland fishes and fisheries, pp. 377-383. In: Craig, J. F. (Ed.). Freshwater Fisheries Ecology. John Wiley & Sons. xvi + 899 pp.

Paykan Heyrati, F. and Dorafshan, S. 2007. Study on the potency of domperidone and metoclopramide for spawning induction in kutum (*Rutilus frisii kutum*). Iranian Journal of Fisheries Sciences, 6(2):105-118.

Paykan Heyrati, F., Moradi, Z. and Dorafshan, S. 2012. Some hematological responses in common carp (*Cyprinus carpio*) subjected to anesthetic dosage of clove powder. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 517-522 (duplicate).

Paykhan Heyrati, F., Moradi, Z. and Forfshan, S. (*sic*) 2012. Some hematological responses in common carp (*Cyprinus carpio*) subjected to anesthetic dosage of clove powder. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 255-260.

Paykan Heyrati, F., Mostafavi, H., Toloee, H. and Dorafshan, S. 2007. Induced spawning of kutum, *Rutilus frisii kutum* (Kamenskii, 1901) using (D-ala6, Pro9-NEt) GnRHa combined with domperidone. Aquaculture, 265(1-4):288-293.

Pazira, A. 2007. Recognizing of ichthyophon (*sic*, ichthyofauna) and investigation of feeding and effects of water temperature, salinity and electrical conductivity on the population dynamic of *Barbus grypus* in the Dalaki and Helle River. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 115 pp. In Farsi.

Pazira, A. 2017. Antifungal effect of *Thymus vulgaris* essence on the separated fungals from koi fish's skin (*Cyprinus carpio* var. koi) in vitro. Journal of Aquaculture Development, 11(2):13-22. In Farsi.

Pazira, A., Abdoli, A., Ghanbari, F. and Moghdani, S. 2016. Comparison of fish species diversity in Dalaki and Helleh Rivers of the Persis basin in Bushehr Province. Iranian Journal of Ichthyology, 3(3):222-228.

Pazira, A., Vosughi, Kh. and Abdoli, A. 2011. Age and growth of *Barbus grypus* in the Dalaki and Helle rivers of Boushehr Province. Journal of Fisheries, 5(1)(17):57-69. In Farsi.

Pazira, A. A., Abdoli, A., Vosoughi, G. R. and Keyvan, A. 2009. Study on diet of *Barbus grypus* in Dalaki and Helleh rivers. Journal of Marine Biology, 1(3):54-62. In Farsi.

Pazira, A. A. and Vatandoust, S. 2008. A study in the diet of *Barbus luteus* in the Dalaki and Helleh rivers. Journal of Fisheries, 2(2):23-28. In Farsi.

Pazira, A-R., Abdoli, A. and Moghdani, S. 2014. Influences of female age, body size and environmental condition on annual egg production of the *Barbus grypus* (Heckel, 1843), in southern Iran. Advances in Environmental Biology, 8(13):1640-1647.

Pazira, A-R., Ghanbari, F. and Moghdani, S. 2014. Investigation of the population structure of *Capoeta barroisi* (Lortet in Barrois, 1894) in Dalaki River, Bushehr Province, Iran. Advances in Environmental Biology, 8(13):1648-1651.

Pazira, A. R., Javaheri, B. M. and Nayeri, M. 2012. Study of population structure in siah mahi (*Capoeta capoeta intermedia*) in the rivers of Bushehr Province. Journal of Wetland Ecobiology, 3(10):69-76. In Farsi.

Pazira, A-R., Moghdani, S. and Ghanbari, F. 2013. Age structure and growth of the *Garra rufa* (Cyprinidae), in southern Iran. International Journal of Biosciences, 3(12):115-119.

Pazoki, M., Ahmadi Pari, M., Dalaei, P. and Ghasemzadeh, R. 2015. Environmental impact assessment of a water transfer project. Jundishapur Journal of Health Sciences, 7(3):e27238, 9-14.

Pazooki, J. 1996. A faunistical survey and histopathological studies on freshwater fish nematodes in Iran and Hungary. Ph.D. Thesis, Veterinary Medical Research Institute, Hungarian Academy of Sciences. 111 pp.

Pazooki, J., Ghaffar Haddadi, F. and Abtahi, B. 2011. A comparison of heavy metal concentrations in skin and muscle tissues of wild and cultured carp (*Cyprinus carpio*) in the southeastern Caspian Sea area of Iran. Environmental Sciences, 9(1):51-58.

Pazooki, J., Ghasemi, R. and Masoumian, M. 2003. Infections of three species of *Barbus* fishes by helminth parasites in Tadjan and Zaremrood Rivers, Mazandaran Province, Iran. Pajouhesh va Sazandegi, 16(2)(59):80-85. In Farsi.

Pazooki, J., Ghobadian, M. and Masoumian, M. 2005. Identification of some parasites of freshwater fishes of Zanjan Province, northwest Iran. Iranian Scientific Fisheries Journal, 14(1):23-40. In Farsi.

Pazooki, J., Jalali Jafari, B. and Ghobadian, M. 2006. Monogenean species from freshwater fishes of Zanjan province, Iran. Iranian Journal of Fisheries Sciences, 6(1):103-112.

Pazooki, J. and Masoumian, M. 2001. Nematoda parasites isolated from some freshwater fish species in Gilan and Mazandaran provinces. Research and Development Journal, 14(2):93-99. In Farsi.

Pazooki, J. and Masoumian, M. 2012. Synopsis of the parasites in Iranian freshwater fishes. Iranian Journal of Fisheries Sciences, 11(3):570-591.

Pazooki, J., Masoumian, M. and Ghobadian, M. 2005a. Parasitological study on fresh water fishes of Zanjan Province, Iran. European Association of Fish Pathologists, 12th International Conference, “Diseases of Fish and Shellfish”, 11-16 September 2005, Copenhagen (title).

Pazooki, J., Masoumian, M. and Ghobadian, M. 2005b. Identification of parasites of some fishes in water resources of Zanjan Province. Iranian Scientific Fisheries Journal, 14(1):23-40. In Farsi.

Pazooki, J., Masoumian, M., Yahyazadeh, M. and Abbasi, J. 2007. Metazoan parasites from freshwater fishes of northwest Iran. Journal of Agricultural Science and Technology, 9(1):25-33.

Pazooki, J., Masoumian, M., Yahyazadeh, M. Y., Sadri Mehrabad, Gh. R. and Jalali, B. 2008. Monogenean parasites from fresh water fishes of northwestern Iran. Pajouhesh va Sazandegi, 77(4):17-25. In Farsi.

Pazooki, J. and Molnár, K. 1998. *Philometra karunensis* sp. n. (Nematoda: Philometridae) from *Barbus sharpeyi* (Pisces) in freshwaters of southwest Iran. Acta Veterinaria Hungarica, 46(4):465-472.

Pazooki, J., Nazari Chamak, F. and Masoumian, M. 2012. New host records for fish nematodes from Iran. Journal of Cell and Animal Biology, 6(2):15-20.

Pazooki, J., Tajbakhsh Goorabzarmakhi, F. and Masoumian, M. 2011. Parasitic infection of an endemic fish (*Blicca bjoerkna*) and an exotic (*Hemiculter beucisculus* (*sic*)) in Anzali Lagoon, Caspian Sea, Iran. Iranian Journal of Parasitology, 6(3):66-73.

Pazwash, H. 1983. Iran’s mode of modernization: Greening the desert, deserting the greenery. Civil Engineering, 53(3):48-51.

Pearce, F. 1984. Fall and rise of the Caspian Sea. New Scientist, 104(1433):10-11.

Pearce, F. 1993. Draining life from Iraq’s marshes. New Scientist, 138(1869):11-12.

Pearce, F. 1995. How the Soviet seas were lost. New Scientist, 148(2003):38-42.

Pearce, F. 1997. Changing the game. New Scientist, 154(2085):14-15.

Pearce, F. 2001. Iraqi wetlands face total destruction. New Scientist, 170(2291):4-5.
Pearce, F. 2003. A high price to pay for caviar. New Scientist, 179(2413):6-7.
Pearce, F. 2004. Russia revives epic river plan. New Scientist, 181(2433):8-9.
Pearse, C. K. 1973. Qanats in the Old World: horizontal wells in the New. Journal of Range Management, 26(5):320-321.
Pellegrin, J. 1928. Les poissons des eaux douces d'Asie-Mineure. J.-B. Baillière et Fils, Paris (Extrait du tome second et dernier du Voyage zoologique d'Henri Gadeau de Kerville en Asie-Mineure (Avril-Mai 1912)). 134 pp., 2 pls.
Pelz, G. R. 1987. Der Giebel: *Carassius auratus gibelio* oder *Carassius auratus auratus*? Natur und Museum, 117(4):118-129.
Penning, E. and Beintema, A. 2006. Integrated water resources management for the Sistan closed inland delta, Iran. Annex D. Sistan wetlands ecosystem - functioning and responses. WL Delft Hydraulics, The Netherlands. vii + 91 pp.
Perea, S., Böhme, M., Zupančič, P., Freyhof, J., Šanda, R., Özuluğ, M., Abdoli, A. and Doadrio, I. 2010. Phylogenetic relationships and biogeographical patterns in Circum-Mediterranean subfamily Leuciscinae (Teleostei, Cyprinidae) inferred from both mitochondrial and nuclear data. BMC Evolutionary Biology, 10:265.
Perera, J. 1989. Abandoned canal scheme saves the Caspian Sea. New Scientist, 121(1655):30.
Peritore, N. P. 1999. Third World Environmentalism. Case Studies from the Global South. University Press of Florida, Gainesville. xii + 328 pp.
Perkins, S. 2002. Once upon a lake. Science News, 162(18):283-284.
Perry, C. 1998. Medieval Arab fish: fresh, dried and dyed, pp. 229-233. In: Walker, H. (Ed.). Fish. Food from the Waters. Proceedings of the Oxford Symposium on Food and Cookery 1997. Prospect Books, Totnes, Devon. 335 pp.
Petr, T. 1987. Observations on prospects for further inland fisheries development in Iran. A Mission report for the project Training in Coldwater Fish Culture. Technical Cooperative Programme, FAO, FI:TCP/IRA/6675, Field Document 2:vi + 71 pp.
Petr, T. (Ed.). 1999. Fish and fisheries at higher altitudes. Asia. Food and Agriculture Organization, Rome, Fisheries Technical Paper, 385:v + 304 pp.
Petr, T. and Marmulla, G. 2002. Report of the FAO expert consultation on the use of irrigation systems for sustainable fish production in arid countries of Asia, Almaty, Kazakhstan, 25-29 September 2001. Food and Agriculture Organization, Rome, Fisheries Report, 679:ix + 22 pp.
Petrov, V. V. 1926. K poznaniyu kavkazskikh ukleyek (genus Alburnus Heck.). [To the knowledge of the Caucasian bleaks (genus Alburnus Heck)]. Izvestiya Bakinskoi Ikhtiologicheskoi Laboratorii, 2(1):133-160.
Petrov, V. V. 1930. Die geographische Variabilität von Alburnus alburnus L. Zoologischer Anzeiger, 88(5/6):141-150.
Peyghan, R. 1994. Treatment of ichthyophthiriasis in Barbus sharpeyi in Khouzestan Province. Iranian Fisheries Scientific Journal, 3(2):17-24, 2. In Farsi.
Peyghan, R. 2003. Effects of intraperitoneal and intramuscular injection of killed Aeromonas hydrophila on common carp lymphocytes. Aquarama, The 8th International Aquarium Fish & Accessories Exhibition & Conference, Singapore, 30 Oct to 2 Nov 2003 (title).
Peyghan, R., Alboughobish, N., Pourmahdi Brojeni, M. and Rasekh, A. A. R. 2002. Study of some biological and histological factors of common carp, *Cyprinus carpio*, gonad in two culture season. Pajouhesh va Sazandegi, 15(2)(55):16-23. In Farsi.

Peyghan, R. and Azary Takami, G. 2002. Histopathological, serum enzyme, cholesterol and urea changes in experimental acute toxicity of ammonia in common carp *Cyprinus carpio* and use of natural zeolite for prevention. Aquaculture International, 10(4):317-325.

Peyghan, R., Baniadam, A. and Amirdad, S. H. 2001. Using ketamine and xylazine hydrochloride for anaesthesia of common carp (*Cyprinus carpio*). Pajouhesh va Sazandegi, 14(3)(52):18-19. In Farsi.

Peyghan, R., Gooraninejad, S., Shahriari, A. and Jamshidi, Z. 2012. Feeding effect of cholesterol in the diet on sex hormones concentrations and the gonads' growth of yearling common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Medicine, 6(1):23-28.

Peyghan, R. and Mashaea, M. A. 2005. Management of warm water fish culture ponds. Norbakhsh and Daryasar Publication, Tehran University. 55 pp.

Peyghan, R., Mesbah, M., Rasekh, A. and Mohammadi Dehchashmeh, M. 2002. The investigation on deleterious effect of malachite green on hatching eggs of silver carp (*Hypophthalmichthys molitrix*). Iranian Veterinary Journal, 5(8):67-73. In Farsi.

Peyghan, R., Mesbah, M. A., Mohammadi Dehchashmeh, M. and Rasekh, A. 2006. Teratologic and gross pathological effect of malachite green bath on the eggs and larvae of silver carp *Hypophthalmichthys molitrix*). Shahid Chamran University Journal of Science, 15(B):27-34. In Farsi.

Peyghan, R., Nabavi, L. and Hosseini, M. R. 2001. The prevalence of helminth parasites in intestines of *Capoeta trutta*, *Barbus barbulus* and *Barbus grypus* in Khorramabad rivers. Iranian Veterinary Journal, 4(7):55-66. In Farsi.

Peyghan, R., Najafzadeh Varzi, H. and Jamzadeh, E. 2011. Determination of furazolidone residues in muscles of the cultured common carp following experimental bath and oral administration. Journal of Veterinary Research, 67(1):71-75. In Farsi.

Peyghan, R., Parvar, N., Esmaeilzadeh, S. and Hoghoughirad, N. 2001. Histopathological survey of infection of *Barbus grypus* gills by *Myxobolus karuni* in Karun River. Iranian Journal of Veterinary Research, Shiraz University, 2(1):63-70.

Peyghan, R., Raazi Jalali, M. and Dastour Nejad, F. 2003. Study of normal serum enzymes (ALT, AST, ALP, LDH) levels in common carp, grass carp and silver carp. Pajouhesh va Sazandegi, 16(1)(58):90-93. In Farsi.

Peyghan, R., Razi Jalali, M. and Salehe, B. 2017. Serum biochemical changes following treatment with metronidazole and levamisole in common carp. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 751-756. In Farsi.

Peyghan, R., Shokoohmand, M. and Tulaby Dezfuly, Z. 2017. Case study of common carp mortalities due to *Microcystis* and *Anabaena* algal blooms in Khuzestan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 108-112. In Farsi.

Peyghan, R., Tulaby Dezfuly, Z., Razijalali, M. H., Mohammadian, B. and Afra, A. 2018. Study on parasitic contamination of Botak (*Cyprinion macrostomum*), Toeini (*Barbus barbulus*) and Kaputa (*Capoeta trutta*) in Dez River. Journal of Wetland Ecobiology, 10(2):15-28. In Farsi.

Peykanheraty, F., Khalaji, M., Zangeneh, M., Mahbobi Sofyani, N. and Dorafshan, S. 2016. Histopathological effects of cadmium chloride on liver and gill of *Chondrostoma regium*. Iranian Scientific Fisheries Journal, 25(2):107-117. In Farsi.

Peykaran M. 2012. The study of increasing production of warm water fish per unit area in West

Azarbaijan Province with using aeration and nutrition management. Iranian Fisheries Science Research Institute, Tehran. 63 pp. In Farsi.
Pietschmann, V. 1940. Durch Kurdische Berge und Armenische Städte. Tagebuch der Armenischen Expedition 1914. Adolf Luser, Wien. 398 pp., 200 figs., map.
Pilmal, M., Alizadeh Doughikollaee, E. and Elahi, M. Y. 2018. Effect of edible chitosan coating containing cinnamon essential oil on the shelf life of silver carp fish finger during refrigerated storage. Journal of Fisheries (Iranian Journal of Natural Resources), 71(3):294-305. In Farsi.
Pinkerton, J. (Ed.). 1758-1826. A General Collection of the Best and Most Interesting Voyages and Travels in All Parts of the World; many of which are now first translated into English, digested on a new plan. Longman, Hurst, Rees, Orme, and Brown, and Cadell and Davies, London. 17 volumes.
Pipoyan, S. Kh. 1996a. *Pseudorasbora parva* (Cypriniformes, Cyprinidae) in water bodies of the Ararat Plain (Armenia). Journal of Ichthyology, 36(7):536-538.
Pipoyan, S. Kh. 1996b. Bitterling *Rodeus* (*sic*) *sericeus amarus*, a new species in the fauna of Armenia. Journal of Ichthyology, 36(8):676-678.
Pipoyan, S. Kh. 1998. *Gobio gobio* (L.) (Cyprinidae), a new species of fauna in Armenia. Journal of Ichthyology, 38(6):441-446.
Pipoyan, S. Kh. and Arakelyan, M. S. 1999. *Acanthalburnus microlepis* in water bodies of Armenia. Journal of Ichthyology, 39(9):726-731.
Pipoyan, S. Kh. and Kirakosyan, L. A. 1998. The Azerbaijan bleak (*Alburnus charustini* (*sic*) *hohenackeri* Kessler) (Cyprinidae) in Armenian waters. Journal of Ichthyology, 38(7):547-551.
Pipoyan, S. Kh. and Rukhkyan, R. G. 1998. Reproduction and development of *Carassius auratus gibelio* in water bodies of Armenia. Journal of Ichthyology, 38(5):374-379.
Pipoyan, S. Kh. and Tigranyan, E. A. 2002. Recent ichthyofauna of Armenia. Journal of Ichthyology, 42(8):575-578.
Pirali Kheirabadi, E., Shafie, S., Mansour, P., Taheri Mirghaed, A., Mohamadian, S., Rouholahi, S. and Mohktari. A. 2012. Identification and study of fish species in Zayandehrood River, Iran (Chaharmahal va Bakhtiary basin). XIV European Congress of Ichthyology, Liège, Belgium, 3-8 July 2012 (poster).
Pirali-khierabadi, E., Hosseini-Shekarabi, S. P. 2014. Protozoan parasites of some endemic fishes in Bazoft river, Iran. Annals of Biological Research, 5(5):11-14.
Pirali-Khierabadi, E., Hosseini-Shekarabi, S. P. and Salehi, M. 2015. Identification of metazoan parasites of some native fish from Bazoft River, Iran. AACL Bioflux, 8(5):627-631.
Pirali Khirabadi, E., Moradi Chaffi, M., Mansouri, P. and Alavi-Yeganeh, M. S. 2017. Identification and distribution of Bazoft River fish fauna. Journal of Animal Environment, 9(2):147-152. In Farsi.
Pirali-Zafarahi, A. R. and Ebrahimi Drache, H. 2016. Assessing the water quality of Zayandeh Rud River affected of drought period using BMWP, ASPT and Hilsenhoff biological indices. Journal of Utilization and Cultivation of Aquatics, 4(4):71-85. In Farsi.
Pirali Zefrehei, A. R., Hedayati, A., Pourmanafi, S., Beyraghdar Kashkooli, O. and Ghorbani, R. 2020. Monitoring spatiotemporal variability of water quality parameters using Landsat imagery in Choghakhor International Wetland during the last 32 years. International Journal of Limnology, 56:doi:10.1051/limn/2020004.
Pirali Zefrei, A. R., Ebrahimi Dorcheh, E. and Motamedi Tehrani, J. 2015. Effects of different

levels of pistachio's dried hull (*Pistachia* (*sic*) *vera*) in diet on growth and feeding indices of common carp (*Cyprinus carpio*). New Technologies in Aquaculture Development (Journal of Fisheries), 10(3):59-66. In Farsi.

Pirani, A., Vatandoust, S., Torabi, D. S. and Kamali, A. 2013. Identification and abundance of fish in the Godarkhosh River (Ilam Province). Renewable Natural Resources Research, 3(4)(10):17-27. In Farsi.

Pirani, F., Moradi, S., Ashouri, S., Johari, S. A., Ghaderi, E., Kim, H. P. and Yu, I. J. 2021. Dietary supplementation with curcumin nanomicelles, curcumin, and turmeric affects growth performance and silver nanoparticle toxicity in *Cyprinus carpio*. Environmental Science and Pollution Research, doi:10.1007/s11356-021-15538-2.

Piravar, Z. 2006. Karyotype of some freshwater fishes of Fars province. M.Sc. Thesis, Shiraz University, Shiraz. In Farsi.

Pirbeigi, A., Poorbagher, H., Eagderi, S. and Mirvaghefi, A. R. 2016. Pathological effects of sublethal diazinon on the blood, gill, liver and kidney of the freshwater fish *Capoeta damascina*. Chemistry and Ecology, 32(3):270-285.

Pirbeigi, A., Poorbagher, H., Eagderi, S. and Mirvaghefi, A. R. 2013. Effects of diazinon on hematological parameters of *Capoeta damascina*. Journal of Fisheries (Iranian Journal of Natural Resources), 66(4):399-412. In Farsi.

Piri, H. 2011. Estimation environmental water requirement of wetland hamoun. Journal of Wetland Ecobiology, 2(6):57-69. In Farsi.

Piri, H. 2013. Investigation on the feasibility of cultivation of fingerling of the roach (*Rutilus rutilus caspicus*) until marketable size in the earthen pond with brackish and fresh waters. Iranian Fisheries Science Research Institute, Tehran. 51 pp. In Farsi.

Piri, I., Nezhad, I. M. and Amirian, P. 2009. Investigation of fish species diversity in Haraz River. Proceedings of the 2009 International Conference on Chemical, Biological and Environmental Engineering (CBEE 2009), World Scientific Publishing, Singapore, pp. 323-328.

Piri, M., Nezami, Sh. and Ordog, V. 1999. Effects of diazinon, malathion, machete and saturn on mortality of fingerling of *Rutilus frisii kutum*. Iranian Scientific Fisheries Journal, 7(4):9-18, 2. In Farsi.

Piri, M. and Ördog, V. 1999. Effect of chemical herbicides and insecticides on mortality and feeding of silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Fisheries Sciences, 1(2):11-21.

Pirnia, H. 1951. Experience in integrated development of a river basin. Excerpt from an economic report on the conservation and utilization of the natural resources of Iran (with reference to the Iranian seven-year plan for reconstruction and development), pp. 162-165. Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources. 17 August - 6 September 1949, Lake Success, New York. Department of Economic Affairs, United Nations, New York. 466 pp.

Piroozi, F. and Tavakoli, M. 1996. Survey of the ecosystem of Pol-e Dohktar wetlands. Abzeeyan, Tehran, 7(9):12-16. In Farsi.

Pirsaheb, M., Khamutian, R. and Pourhaghighat, S. 2015. Review of heavy metal concentrations in Iranian water resources. International Journal of Health and Life Sciences, 1(1):35-45.

Pirshaeb, M., Sharafi, K., Dargahi, A., Cheraghi, M., Azizi, E., Khosravi, T. and Ghayebzadeh, M. 2015. Effect of municipal and industrial wastewater effluents on the chromium and vanadium residues in muscle tissue of *Cyprinion macrostomum* and *Chondrostoma*

regium fish in Kermanshah Gharasou River (2013). Journal of Food Hygiene, 4(4):75-84. In Farsi.

Pishkahpour, Z., Eagderi, S. and Mohammadi, H. 2018. Review of studies on Iranian cavefish *Garra typhlops*. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Pishkahpour, Z., Poorbagher, H. and Eagderi, S. 2019a. Comparing efficiency of traditional and geometric morphometrics in distinguishing populations of *Alburnus doriae* in the central and western basins of Iran. Journal of Applied Ichthyological Research, 7(2):1-12. In Farsi.

Pishkahpour, Z., Poorbagher, H. and Eagderi, S. 2019b. Effects of ecological conditions and physical variables of the Dinvarab River in Kermanshah Province on the habitat suitability index of *Alburnus sellal* (Heckel, 1843). Journal of Fisheries (Iranian Journal of Natural Resources), 71(4):317-328. In Farsi.

Plattner, F. 1955. Über den Salzgehalt des Urmia-Sees. Petermanns Geographische Mitteilungen, 99:276-278.

Podsevalov, V. N. 1935. Khimicheskii sostav otdel'nykh chastei tela ryb yuzhnogo poberezh'ya Kaspiya [Chemical composition of various parts of fish off the South Caspian coast]. Izvestiya Astrakhanskogo Otdeleniya Nauchno-Issledovatel'skogo Instituta Rybnoi Promyshlennosti, 2:241-260.

Pohlman, J. W. and Naismith, J. M. 1996. Geographic information systems in action. Quarterdeck, College Station, Texas, 4(3):6 pp. (internet version).

Polat, N. and Gümüş, A. 1995. Age determination and evaluation of precision using five bony structures of the brond-snout (*sic*) (*Chondrostoma regium* Heckel, 1843). Turkish Journal of Zoology, 19(4):331-335.

Polat, N., Gümüş, A. and Kandemir, S. 1999. Kababurun baliğı (*Chondrostoma regium* (Heckel, 1843))'nda yaş halkasıoluşumu [Annulus formation in Tigris-nase (*Chondrostoma regium* (Heckel, 1843))]. Turkish Journal of Zoology, 23, supplement 3:959-964.

Polat, N. and Işik, K. 1995.Altınkaya Baraj Gölündeki Siraz Balığı (*Capoeta capoeta* Guldenstaedt, 1773)'nin Yaş Belirleme Yöntemleri ile Büyüme Özellikleri [Ageing methods and growth rates of siraz balığı (*Capoeta capoeta* Guldenstaedt, 1773) in Altınkaya Dam Lake]. Turkish Journal of Zoology, 19(3):265-271.

Ponnazar, M., Imanpurmin, J. and Farzi, R. 2018. The relationship between length and weight of *Capoeta razii* blackfish in Shahroud Lushan River, south Caspian basin Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Poorbagher, H., Pirbeigi, A. and Eagderi, S. 2016. Multivariate methods for analyzing the presence-absence data in histological studies of fishes. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Pooria, M., Ghanbari, K., Bahramizadeh, E. and Ejraei, F. 2014. Length-weight relationship and condition factor of *Squalius cephalus* (L., 1758) in Shohadaye Songhor Dam reservoir in Kermanshah province. Journal of Applied Ichthyological Research, 1(4):95-108. In Farsi.

Poorpoode, S. E. and Rahmani, H. 2013. A survey on age and growth of shemaya (*Alburnus chalcoides*: Cyprinidae) in the Shiroud River. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013.

Poosti, A. S. and Marvdasti, S. 1999. Atlas of Fish Histology (normal and pathological forms). Tehran University Press. 328 pp. In Farsi.

Popov, S. V., Rögl, F., Rozanov, A. Y., Steininger, F. F., Shcherba, I. G. and Kovac, M. (Eds.). 2004. Lithological-Paleogeographic maps of Paratethys. 10 maps Late Eocene to Pliocene. Courier Forschungsinstitut Senckenberg, 250:46 pp., annex.

Por, F. D. 1975. An outline of the zoogeography of the Levant. Zoologica Scripta, 4(1):5-20.

Por, F. D. 1987. The Levantine landbridge: historical and present patterns, pp. 23-28. In: Krupp, F., Schneider, W. and Kinzelbach, R. (Eds.). Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, Mainz, 1985. Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe A (Naturwissenschaften), 28, Dr. Ludwig Reichert Verlag, Wiesbaden, 338 pp.

Por, F. D. and Dimentman, Ch. 1989. The Legacy of Tethys. An Aquatic Biogeography of the Levant. Monographiae Biologicae, 63:xi + 214 pp.

Poria, M., Abdoli, A., Hashemzadeh Segharlou, I., Nouri, F., Ghanbari, K. and Fatahi, A. 2015. Comparison of length-weight relationship of *Capoeta trutta* (Heckel, 1843) in Alvand and Gamasiab rivers in Kermanshah province. Journal of Applied Ichthyology Research, 2(4):59-70. In Farsi.

Poria, M., Abdoli, A., Kazemian, M., Nori, F. and Ejraei, F. 2014. Survey of some parameters of population dynamic of *Capoeta trutta* in Gamasiab River in Kermanshah Province. Journal of Fisheries, 8(2):1-6. In Farsi.

Poria, M., Abdoli, A., Kazemian, M., Nori, F., Khara, H. and Ejraei, F. 2012. Survey of some properties of population dynamic of *Capoeta trutta* in Alvand River in Kermanshah Province (IR. Iran). Journal of Aquatic Animals and Fisheries, 3(10):17-25. In Farsi.

Poria, M., Abdoli, A., Kazemian, M., Nouri, F., Ghanbari, K. and Ejraei, F. 2014. Study of reproductive characteristics of *Capoeta trutta* in Gamasyab River, Kermanshah Province, Iran. International Journal of Biosciences, 4(2):39-46.

Poria, M., Abdoli, A., Nouri, F. 2014. Study of reproductive characteristics of *Capoeta* in Alvand River, Kermanshah Province, Iran. Journal of Biodiversity and Environmental Sciences, 4(1):128-134.

Poria, M., Bahramizadeh, E., Nouri, F. and Shahbazi, K. 2014. Study of morphometric and meristic characteristics of (*Squalius cephalus*) in Shohaday-e-Songhor Dam Lake, Iran. Journal of Aquatic Animals and Fisheries, 5(19):27-34. In Farsi.

Poria, M., Nouri, F., Ghanbary K. and Ejraei, F. 2013. Path coefficient and path analysis of body weight and biometric traits in male *Capoeta trutta* (Heckel, 1843) in Gamasiab River of Kermanshah Province (West of Iran). International Journal of Agriculture and Crop Sciences, 2013-6-10:545-549.

Poria, M., Nouri, F., Ghanbary, K. and Heshmatzad, P. 2013. Interrelationships between morphometric variables and body weight *Capoeta trutta* (Heckel, 1843) evaluated by path analysis in Gamasiab River of Kermanshah Province, west of Iran. World Journal of Fish and Marine Sciences, 5(6):674-679.

Poria, M., Nouri, F., Veisi, A., Karamy, M. and Asadi, T. 2013. Path coefficient and path analysis of body weight and biometric traits in male *Capoeta trutta* (Heckel, 1843) in Alvand River of Kermanshah Province, (West of Iran). International Journal of Farming and Allied Sciences, 2013-2-23:1060-1064.

Poshtpanah, S., Mohammed Alikhani, M., Najar Lashgari, S. and Hosseini Shekarabi, S. P. 2016. Determination of glyphosate herbicide median lethal concentration (LC_{50} 96H) on fry common carp (*Cyprinus carpio*). Breeding and Aquaculture Sciences Quarterly, 4(8):23-36. In Farsi.

Potki, N., Falahatkar, B. and Alizadeh Moghadam Masouleh, A. R. 2012. Replacement of fish meal by corn gluten meal in common carp *Cyprinus carpio* diet. Aqua 2012, 1-5 September 2012, Prague (title).

Potts, D. T. 2012. Fish and fishing, pp. 220-235. In: Potts, D. T. (Ed.). A Companion Guide to the Archaeology of the Ancient Near East. Blackwell, London. xxxv + 1500 pp.

Pourabasali, M., Esmaili, M., Gholizadeh, M. and Peyvandi, A. 2012. Effects of probiotic *Lactobacillus* sp. in the diet on hematological and boichimical (*sic*) factors of common carp (*Cyprinus carpio*) fingerlings. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 529-535.

Pourabasali, M. and Ghobadi, S. 2020. The effect of isolated bacteria from the intestinal duct of beluga (*Huso huso*) fingerling on biochemical compounds of body extract, excretion of metabolic nitrogen and survival of common carp (*Cyprinus carpio*) larvae against environmental stresses. Journal of Fisheries (Iranian Journal of Natural Resources), 73(4):607-618. In Farsi.

Pourabasali, M., Peyvandi, N. and Gholi Zadeh, M. 2012. Reproductive biology of Kura barbel (*Barbus lacerta*) in Babolrood River, northern Iran. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 546-557.

Pourali, S., Khazab, M., Kiabi, B. and Sheidai, M. 2000. Karyological study of two populations of *Capoeta capoeta* from north Iran. Cytologia, 65(3):231-234.

Pourali Darestani, S., Bazyar Lakeh, A. A. and Hassan Zadeh Kiabi, B. 2006. A karyological study of *Barbus capito*, *Barbus mursa* and two populations of *Capoeta capoeta* from northern Iran. Iranian Journal of Natural Resources, 58(4):831-842. In Farsi.

Pouralimotlagh, S., Mohammadi Zarejabad, A. and Ahmadifar, E. 2010. Effects of different dietary lipid sources on growth performance, salinity tolerance, haematological and biochemical parameters of Caspian roach (*Rutilus rutilus caspicus*) juvenile. Journal of Applied Aquaculture, 22(1):74-85.

Pourang, N. 1993. Investigation of the bioaccumulation of heavy metals in the tissues of two fish species in Anzali Wetland with regard to their position in food chain and environmental conditions. M.Sc. Thesis, Tehran University.

Pourang, N. 1995. Heavy metal bioaccumulation in different tissues of two fish species with regards to their feeding habits and trophic levels. Environmental Monitoring and Assessment, 35(3):207-219.

Pourang, N. 1996. Heavy metal concentrations in surficial sediments and benthic macroinvertebrates from Anzali wetland, Iran. Hydrobiologia, 331(1-3):53-61.

Pourang, N., Eslami, F., Nasrollahzadeh Saravi, H. and Fazli, H. 2016. Strong biopollution in the southern Caspian Sea: the comb jelly *Mnemiopsis leidyi* case study. Biological Invasions, 18(8):2403-2414.

Pourang, N., Parafkandeh, F., Moazami, H., Agha Aligol, D., Ghavam Mostafavi, P. and Mahmoudian, M. 2018. Applications of elemental fingerprinting for population discrimination and biomonitoring potential assessment of *Rutilus kutum* from the southern Caspian Sea. Iranian Scientific Fisheries Journal, 27(1):81-97. In Farsi.

Pourasadi, S. 2021. Microplastics and the seas biodiversity. The second national conference on

the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Pourasdi, M., Aminian, B., Avakh, M., Rahanandeh, M. and Sobhani, M. 2017. A study on *Rutilus frisii kutum* migration and propagation in west Guilanian Rivers during last decade. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Pourasdi, M., Rahanandeh, M., Avakh, M., Aminian, B. and Malaki, A. 2017. A study on grass carp growth in a multiple application system. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Pourashouri, P., Yeganeh, S. and Shabanpour, B. 2015. Chemical and microbiological changes of salted Caspian kutum (*Rutilus frisii kutum*) roe. Iranian Journal of Fisheries Sciences, 14(1):176-187.

Pourebrahim, S. 2016. Integrating ecosystem services into the DPSIR framework for sustainable wetland management, pp. 98-109. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Pouresmaeilian, M., Khara, H. and Ahmadnezhad, M. 2015. Studying the process of sexual maturation of Caspian Sea adult male shemaya *Alburnus chalcoides* (Güldenstädt, 1772) migratory to Anzali Wetland. Journal of Applied Ichthyology Research, 3(1):1-14. In Farsi.

Pouresmaeilian, M., Khara, H. and Ahmadnezhad, M. 2016. Study of sex steroid hormones and ovarian histology in female shemaya (*Alburnus chalcoides*) migratory to Anzali Wetland. Journal of Experimental Animal Biology, 5(1):9-22. In Farsi.

Pouresmaeilian, M., Khara, H. and Ahmadnezhad, M. 2017. Sex steroid levels, reproductive indices and histological examination of gonads in adult male and female Caspian shemaya, *Alburnus chalcoides*. Iranian Journal of Fisheries Sciences, 16(4):1325-1332.

Pourgholam, R., Hassan, M. D., Kokoolaki, S., Khoshbavar Rostami, H. A., Mokarrami Rostami, A. and Pourgholam, M. A. 2013. Some hematological and biochemical changes in blood serum of grass carp (*Ctenopharyngodon idella*) vaccinated with *Aeromonas hydrophila* following exposure to sublethal concentration of diazinon. Iranian Journal of Fisheries Sciences, 12(1):12-23.

Pourgholam, R., Laluie, F., Binae, M. and Nader, M. 2017. Stablish (*sic*) of gene bank on the Caspian Sea bony fish. Iranian Fisheries Science Research Institute, Tehran. 100 pp. In Farsi.

Pourgholam, R., Malek, M. and Shamsi, Sh. 1995. Infection with *Clinostomum complanatum* in *Capoeta capoeta* in Shiroud River. Proceedings of the 7th Congress on Food Industries, Tehran University, Tehran, Iran, 23-25 January 1995, pp. 54-55.

Pourgholam, R., Nasrollahzadeh Saravi, H., Saeedi, A. A., Makhlough, A., Vahedi, F. and Rostamian, M. T. 2013. Study on chemical and organic (cow manure) fertilizers on biotic and abiotic of warm water fish ponds in Mazandaran Province. Journal of Aquaculture Development, 7(3):11-22. In Farsi.

Pourgholam, R., Soltani, M., Hassan, D. M., Esmaeili, F., Farhoomand, H. and Usefi, P. 2001. Evaluation of blood characteristics of grass carp (*Ctenopharyngodon idella*) after exposure to organophosphate, diazinon. Iranian Journal of Fisheries Sciences, 3(2):1-18, 120-121.

Pourgholam, R., Soltani, M., Hassan, M. D., Ghoroghi, A., Nahavandi, R. and Pourgholam, H. 2006. Determination of diazinon LC50 in grass carp (*Ctenopharyngodon idella*) and the

effect of sublethal concentration of toxin on some hematological and biochemical indices. Iranian Journal of Fisheries Sciences, 5(2):67-82.

Pourgholami Moghaddam, A. and Abdollahpour Biria, H. 2011. Determine the returned rate of cultured Cyprinidae released in west part of Anzali Lagoon in 2006. New Technologies in Aquaculture Development (Journal of Fisheries), 4(4):23-30. In Farsi.

Pourgholami Moghaddam, A., Khodaparast, S. H., Moradi, M. and Nikpour, M. 2018. Population survey of non-native *Carassius gibelio* fish in Lake Neur. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Pourgholami Moghaddam, A., Sohrabi, T., Salavatian, M. and Babaee, H. 2017. Study of product increasing in the Vahdat dam lake in East Azarbayjan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Pourjafar, M. R., Sadeghi, A. R. and Ahmadi, F. 2010. Developing sustainable landscape design principles in order to achieve natural landscape revitalization of Shiraz Khoshk River. Environmental Sciences, 7(4):193-202. In Farsi.

Pourkazemi M., Asadian, H., Pazouki, J., Masoumian, M. and Ebrahimzadeh Mousavi, H. A. 2007. Introducing molecular markers for *Lernaea cyprinacea* and *Lernaea ctenopharyngodoni* using RAPD technique. Iranian Scientific Fisheries Journal, 16(3):19-28. In Farsi.

Pourkazemi, M., Kazerooni Monfared, F., Bagherzadeh, F. and Nowruzfashkhami, M. R. 2010. Karyotyping of *Vimba vimba persa*. Iranian Scientific Fisheries Journal, 19(2):19-30. In Farsi.

Pourkazemi, M., Nazari, S. and Bakhshalizadeh, S. 2010. Karyotype analysis in white bream (*Blicca bjoerkna transcaucasica*) from north coast of Iran. Iranian Journal of Fisheries Sciences, 9(3):454-463.

Pourkazemi, M. and Razikazemi, S. 2011. Failure of PCR-RAPD technique to differentiate sex in mahisafied (*Rutilus frisii kutum*) from the south Caspian Sea. Caspian Journal of Environmental Sciences, 9(2):235-242.

Pourkhabbaz, A., Mansouri, B., Sinkakarimi, M. H., Rajaei, G. and Vajdi, R. 2016. Acute toxicity bioassay of the mercury chloride and copper sulphate in *Rutilus caspicus* and *Rutilus kutum*. International Journal of Aquatic Biology, 4(1):25-30.

Pourkhabbaz, A. and Mohseni, Z. 2013. The study of bioaccumulation and elimination of copper in blackfish (*Capoeta fusca*) organs from the east qanats of Iran. Veterinary Journal (Pajouhesh va Sazandegi), 25(4)(97):29-37. In Farsi.

Poursaeid, S. 2021. Conservation of endemic fish genetic resources using stem cells. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Poursaeid, S., Kalbassi, M. R., Falahatkar, B., Efatpanah, I., Rahmati, M. and Meknatkhah, B. 2014. Karyological study of F1 hybrids between female asp and male kutum (*Aspius aspius* ♀ x *Rutilus frisii* ♂). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Pourshabanan, A., Yazdani Moghadam, F., Aliabadian, M. and Ghassemzadeh, F. 2016a. Species diversity and distribution of the genus *Garra* in Iran. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Pourshabanan, A., Yazdani Moghadam, F., Aliabadian, M. and Ghassemzadeh, F. 2016b. Phylogeny of *Garra* genus from Razavi Khorasan Province inferred by cytochrome oxidase subunit 1. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Pourshabanan, A., Yazdani Moghaddam, F., Aliabadian, M., Ghasemzadeh, F. and Mousavi-Sabet, H. 2017. Phylogenetic status of *Rutilus* based on cytochrome oxidase subunit I. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Pourshabanan, A., Yazdani Moghaddam, F., Aliabadian, M., Ghasemzadeh, F., Mousavi-Sabet, H. and Damadi, E. 2021. Investigation of species diversity of the subfamily Leuciscinae (Order: Cypriniformes) in the Caspian Sea basin using molecular approach. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Pourshabanan, A., Yazdani Moghaddam, F., Ghasemzadeh, F. and Damadi, E. 2017. Morphometric studies and meristic characteristics of *Garra rufa* Heckel, 1843 in the Bashar River, Kohkiloyeh and Boyerahmad. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 33-39. In Farsi.

Pourshabanan, A., Yazdani-Moghaddam, F., Ghasemzadeh, F., Mousavi-Sabet, H. and Aliabadian, M. 2021. Morpho-species of the genus *Leuciscus* Cuvier, 1816 (Teleostei: Leuciscinae) from Iran revisited using molecular approaches. Zoology in the Middle East, 67(3):1-7.

Poursoufi, T., Mansouri, B. and Gharanjik, B. M. 2020. Biological condition of the Golestan Dam reservoir based on primary products. New Technologies in Aquaculture Development (Journal of Fisheries), 14(31):44-55. In Farsi.

Pourzargham, M. R. 1994. Helminth parasites of fishes in Zarinehrud River. Doctor of Veterinary Medicine Thesis, Islamic Azad University, Urmia Branch, Urmia. 72 pp.

Pousti, I. and Seddigh Marvasti, A. 2000. Fish Histological Atlas (normal and pathological forms). Tehran University Publishing. 328 pp. In Farsi.

Pravdin, I. F. 1927. *Rutilus rutilus caspicus* natio *knipowitschi*. Vobla iz Astrabadskogo zaliva [*Rutilus rutilus caspicus* natio *knipowitschi*. The roach of the Astrabad Lagoon]. Sbornik v chest' Professora Nikolaya Mikhailovicha Knipovicha 1885-1925, Moskva, 1927:83-88.

Pretzmann, G. 1973. Bericht über eine Sammelreise nach Iran und Anatolien 1970. Annalen des naturhistorischen Museums in Wien, 77:321-329.

Pretzmann, G. 1974. Bericht über eine Sammelreise nach Iran im Frühjahr 1972. Annalen des naturhistorischen Museums in Wien, 78:453-455.

Priem, F. 1908. Poissons fossiles de Perse (Mission de Morgan). In: Annales publiées sous la direction de J. Morgan, Paris, pp. 1-25, pl. I-III.

Proudlove, G. S. 1997a. A synopsis of the hypogean fishes of the world. Proceedings of the 12th International Congress of Speleology, La Chaux de Fonds, Switzerland, August 1997, 3:351-354.

Proudlove, G. S. 1997b. The conservation status of hypogean fishes. Proceedings of the 12th International Congress of Speleology, La Chaux de Fonds, Switzerland, August 1997, 3:355-358.

Proudlove, G. S. 2001. The conservation status of hypogean fishes. Environmental Biology of Fishes, 62(1-3):201-213.

Proudlove, G. S. 2006. Subterranean Fishes of the World. An account of the subterranean (hypogean) fishes described up to 2003 with a bibliography 1541-2004. International Society for Subterranean Biology, Moulis. xviii + 300 pp.

Proudlove, G. S. 2010. Biodiversity and distribution of the subterranean fishes of the world, pp. 41-64. In: Trajanao, E., Bichuette, M. E. and Kapoor, B. G. (Eds.). Biology of Subterranean Fishes. CRC Press. 494 pp.

Purabbasali, M., Esmaeili, M., Ghobadi, S., Jafarian, H. and Gholizadeh, M. 2015. Effect of performance of isolated sturgeon gut *Bacillus* (*Huso huso*) on survival and body extract on common carp (*Cyprinus carpio*) larvae. Breeding and Aquaculture Sciences Quarterly, 2(5):25-40. In Farsi.

Puria, M., Shahmahmoodi, S., Valiallahi, J., Ghazi Harsini, M., Heidari, B. and Goodarzi, B. 2013. Distribution and diversity of native fishes of Kermanshah province. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 25 (abstract).

Pyka, J., Bartel, R., Szczerbowksi, J. A. and Epler, P. 2001. Reproduction of gattan (*Barbus xanthopterus* Heckel), shabbout (*Barbus grypus* Heckel) and bunni (*Barbus sharpeyi* Gunther) and rearing stocking material of these species. Archives of Polish Fisheries, 9(supplement 1):235-246.

Q

Qani Nezhad, D. and Pour Gholami Moghadam A. 1995. Preliminary report of fish stock evaluation in Aras Dam in 1994 (Comprehensive Project of Aras Lake). Gilan Fisheries Research Center, Bandar Anzali.

Qasim, H. H. and Niazi, A. D. 1975. The osteology of *Barbus xanthopterus* & *B. sharpeyi* with special reference to their lateral-line system (Cyprinidae). Bulletin of the Natural History Research Centre, Baghdad, 6(1):73-77.

Qin, B. and Yu, G. 1998. Implications of lake level variations at 6 ka and 18 ka in mainland Asia. Global and Planetary Change, 18(1-2):59-72.

Quanrud, D. (Ed.). 2016. U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.

Quliyev, Z. M. 2006. Azərbaycanda əmtəə balıqçılığı [Azarbaidzhan Fishing]. Baku. 214 pp. In Azerbaijani.

Qureshi, M. R. 1965. Common Freshwater Fishes of Pakistan. Government of Pakistan Press, Karachi. viii + 61 pp.

R

Rabani, M. and Nourouzi, B. 2002. Study on the quality of output water from the Neka Power Station for using in carp culture. Pajouhesh va Sazandegi, 15(1)(54):29-33. In Farsi. 2017. 166:

Rabazanov, N. I., Orlov, A. M., Abdusamadov, A. S., Barkhalov, R. M. and Akhemedkhanov, K. M. 2019. Caspian kutum *Rutilus kutum*: A long story of exploitation, survival, and revival, 24 pp. In: Kreuger, C. C., Taylor, W. W. and Youn, S. J. (Eds.). 2019. From

Catastrophe to Recovery. Stories of Fishery Management Success. American Fisheries Society, Bethesda, Maryland. 572 pp. www.researchgate.net/publication/330521397_Caspian_Kutum_Rutilus_kutum_A_Long_Story_of_Exploitation_Survival_and_Revival.

Rabazanov, N. I., Orlov, A. M., Abdusamadov, A. S., Barkhalov, R. M., Akhemedkhanov, K. M. and Buzulutskaya, K. G. 2017. Состояние запасов, промысел и искусственное разведение кутума [Condition of stocks, fishery, and artificial reproduction of the Caspian kutum]. Trudy VNIRO (Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii), 166:55.71.

Rabbaniha, M. 2016. Environmental and ecological studies in northern Alborz (Golestan Province). Iranian Fisheries Science Research Institute, Tehran. 164 pp. in Farsi.

Rabbaniha, M., Seyfabadi, S. J., Sharifpour, I. and Owfi, F. 2003. Abundance and diversity of fish larvae in the Farakeh creek-estuary area of Bushehr Province. Iranian Journal of Marine Sciences, 2(4):39-48. In Farsi.

Rabiei, S., Hosseini, M., Rezaei, M. and Mousavi, T. 2013. Inhibitory effects of Ajowan essential oil on growth of *Listeria monocytogenes* in *Rutilus frissi* (*sic*) *kutum* broth medium and fillet. Journal of Nutrition Sciences and Food Technology, 8(2):71-80. In Farsi.

Radcliffe, W. 1926. Fishing from the Earliest Times. Second Edition. E. P. Dutton, New York. xxi + 494 pp.

Radde, G. 1899. Die Sammlungen des kaukasichen Museums im Vereine mit Special-Gelehrten Bearbeitet und Herausgegeben. Band I. Zoologie. Museum Caucasicum, Tiflis. I:520 pp., 24 pls.

Radkhah, A. 2015a. The effect of lead (Pb) on haematological parameters of common carp (*Cyprinus carpio*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 170.

Radkhah, A. 2015b. Length-weight relationship and condition factor of *Hemiculter leucisculus* (Basilewsky, 1855) in Anzali Wetland of Iran. Journal of Advanced Botany and Zoology, 3(2):1-3.

Radkhah, A. 2016. A study on length-weight relationship and condition factor of *Alburnus mossulensis* in Hamzeh-Ali Region from Chaharmahal and Bakhtiari Province, Iran. International Journal of Fisheries and Aquatic Sciences, 4(1):124-125.

Radkhah, A. and Eagderi, S. 2015a. Length-weight and length-length relationships and condition factor of six cyprinid species from Zarrineh River (Urmia Lake basin, Iran). Iranian Journal of Ichthyology, 2(1):61-64.

Radkhah, A. and Eagderi, S. 2015b. First record of saw-belly (*Hemiculter leucisculus* Basilewsky, 1855 from Zareinehrud River, Urmia Lake basin and some of its biological characteristics. Journal of Aquatic Biology, Hormozgan University, 4(4):116-121. In Farsi.

Radkhah, A., Eagderi, S. and Mousavi-Sabet, H. 2016. First record of the exotic species *Hemiculter leucisculus* (Pisces: Cyprinidae) in southern Iran. Limnetica, 35(1):175-178.

Radkhah, A., Eagderi, S. and Poorbagher, H. 2021. Investigating the factors affecting on declining of *Luciobarbus capito* stocks in the Caspian Sea basin and proposing solutions for its protection. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Radkhah, A. and Nowferesti, H. 2016a. Study on length-weight relationships and condition factor of *Capoeta trutta* from Kangir and Seimare Rivers, Western Iran. International Journal of Fisheries and Aquatic Studies, 4(1):121-123.

Radkhah, A. and Nowferesti, H. 2016b. Studies on length-weight, length-length relationships and condition factor of *Capoeta aculeata* in Gamasiab river, Kermanshah province, Iran. ABAH Bioflux, 8(1):29-33.

Radkhah, A., Nowferesti, H. and Asgardun, S. 2015. Study on length-weight relationship and condition factor of *Capoeta trutta* in Gamasiab River (Iran). Journal of Advanced Botany and Zoology, 3(4):1-2.

Radkhah, A., Poorbagher, H. and Eagderi, S. 2016. Study of ecological factors on morphometric characteristics of Urmia Kingfish (*Alburnus atropatenae* Berg, 1925) in Siminehroud and Zarinehrud Rivers. Journal of Aquatic Ecology, Hormozgan University, 5(3):12-20. In Farsi.

Radkhah, A., Poorbagher, H., Eagderi, S. and Nasri, M. 2016. The environmental factors influencing the phenotypic plasticity of *Barbus lacerta* (Heckel, 1843) in the Zarrineh River, the Urmia Lake basin, Journal of Fisheries (Iranian Journal of Natural Resources), 68(4):521-531. In Farsi.

Radkhah, A., Pourbagher, H., Eagderi, S. and Nowferesti, H. 2016. Morphological differences in populations of sawbelly, *Hemiculter leucisculus* (Basilewsky, 1855) in Zarrineh River and Anzali Wetland using geometric morphometric method. Journal of Utilization and Cultivation of Aquatics, 5(1):73-82. In Farsi.

Radkhah, A. R., Eagderi, S. and Poorbagher, H. 2019a. Fish species diversity of Fars, by Esmaeili H.R. & Teimori A. 2016. 288 p. Fars Environment Department, ISBN: 978-600-04-5600-9. Iranian Journal of Ichthyology, 6(2):92-97.

Radkhah, A. R., Eagderi, S. and Poorbagher, H. 2019b. Fishes of Guilan, by Abbasi Ranjbar K. 2017. 206 p. Iliya Culture Publication, Rasht, ISBN: 978-964-190-517-2. International Journal of Aquatic Biology, 7(2):112-116.

Radkhah, A. R., Eagderi, S., Poorbagher, H. and Hosseini, V. 2018. An overview of distribution of topmouth gudgeon (*Pseudorasbora parva*) in inland waters of Iran and its ecological effects, pp. 226-236. In: Protection of Iranian Endemic Freshwater Fishes Conference, Fisheries Department, University of Tehran and Iranian Ichthyological Society, Karaj, 19 December 2018. In Farsi.

Radkhah, A. R., Eagderi, S., Poorbagher, H. and Shams, Y. 2020. Investigation of fish fauna and environmental factors influencing biodiversity in the Zarineh River, Urmia Lake basin (West Azerbaijan Province). Iranian Scientific Fisheries Journal, 29(1):81-91. In Farsi.

Radkhah, A. R., Eagderi, S. and Shams, Y. 2020. The fish fauna of the Zarineh River (Urmia Lake basin) downstream sector - conservation and management. Transylvanian Review of Systematical and Ecological Research, 22(1):69-80.

Radkhah, A. R., Poorbagher, H. and Eagderi, S. 2016. Investigation of morphological differences of *Capoeta capoeta* populations in the upstream and downstream of Zarinerood River in Urmia Lake basin. Journal of Animal Environment, 8(3):167-174. In Farsi.

Radmehr, B. and Wossughi, G. 1982. The osteological study of the scull (*sic*) of some fishes in Iran (Pomadasys, Lucioperca and Schizothorax). Journal of the Veterinary Faculty of the University of Tehran, 38(4):51-69. In Farsi.

Raeisi, E. and Nejati, M. H. 2000. Study of the sources of salinity in the Gomban karst spring, southern Iran. Carbonates and Evaporites, 15(2):115-120.

Raeisi, M., Ansari, M. and Rahimi, E. 2010. Determination of lead and cadmium concentration in meat of four species of cyprinid fish from Beheshtabad River, Chaharmahal & Bakhtyari Province and the relation with age and fish species. Journal of Marine Science and Technology Research, 4(4):37-42. In Farsi.

Raeisi, S., Alishahi, A. R., Shaban-Pour, B., Ojagh, S. M., Sharifi-Rad, J. and Iriti, M. 2015. Nutritional composition and antioxidant activity of vobla-roach (*Rutilus rutilus caspicus*) muscle tissue exposed to heavy metals. Bulletin of Environment, Pharmacology and Life Sciences, 4(2):83-90.

Raeisi Sarasiab, A., Hosseini, M. and Tadi Beni, F. 2014. Mercury and methyl mercury concentration in sediment, benthic, *Barbus Grypus* (*sic*) and pelagic, *Barbus esocinus* fish species from Musa estuary, Iran. International Aquatic Research, 6(3):147-153

Rafiee, G. R., Hashemi Panah, A. and Esmaeili Bidhendi, M. 2018. Effect of dietary lettuce (*Lactuca sativa*) on growth indices and body composition of Caspian kutum (*Rutilus kutum*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(4):376-385. In Farsi.

Rafiee, Gh. and Hekmat, N. 2010. Performance of polypropylene and populus (*Populus alba*) shaving, as biofilter media, on water quality, growth and survival of carp (*Cyprinus carpio* Linnaeus, 1758) larvae in a recirculating system. Journal of Fisheries (Iranian Journal of Natural Resources), 63(3):173-180. In Farsi.

Rafiee, H. and Yazdani, S. 2016. Feasibility of designing coastal market in types of bony fish in Mazandaran Province. Agricultural Economics, 10(4):39-54. In Farsi.

Rafique, M. 2007. Biosystematics and distribution of the freshwater fishes of Pakistan with special reference to the subfamilies Noemacheilinae and Schizothoracinae. Ph.D. Thesis, University of Arid Agriculture, Rawalpindi. xxi + 219 pp.

Rahanandeh, M. 2006. Reports on diplostomiasis in Gilan Province. Veterinary Department, Sciences and Research Branch, Islamic Azad University. 27 pp. In Farsi.

Rahanandeh, M. 2010. *S*urvey on parasites of *Rutilus frisii kutum* in South west of Caspian Sea with the emphasis of pathology of *Dactylogyrus frisii* and morphological identification of *Paradiplozoon* sp. and *Anisakis* sp. Ph.D. Thesis, Islamic Azad University, Science and Research Branch, Tehran. 149 pp. In Farsi.

Rahanandeh, M., Alinezhad, S., Khadivinia Moghadam, M. and Hallajian, A. 2016. The pathological study of gastro intestinal *Aspidogaster limacoides* Diesing, of the Caspian Sea kutum fish *Rutilus frisii kutum* (Kamenskii, 1901). International Journal of Fisheries and Aquatic Studies, 4(6):397-399.

Rahanandeh, M., Mobedi, I., Meshgi Mahzad, A., Jalali, B., Aminian Fatideh, B. and Sabet Saeed, S. 2011. Occurrence and intensity rate of internal metazoan parasites in *Rutilus frisii kutum* and the first record of *Dioctophyma renale* of (Nematoda: Dioctophymidae) in Iran. World Journal of Zoology, 6(1):91-97.

Rahanandeh, M. and Rahanandeh, E. 2020. Practical effect of calcium oxide and sodium chloride on the control and treatment of *Ichthyophthirius multifilis* in gold fish (*Carassius auratus*) farms. Iranian Journal of Aquatic Animal Health, 6(1):44-53.

Rahbar, M., Khara, H., Ahmadinezhad, M., Samadi, M., Khodadoust, A., Movahed, R. and Hayatbakhsh, M. R. 2008. Determine of some fecundity indicators in shemaya (*Alburnus chalcoides*, Guldenstaedt 1772) immigrant to the Anzali Wetland. Journal of Biology Science, 2(2)(series no. 5):53-59.

Rahbar, M., Khara, H., Ahmadnejad, M., Samadi, M., Khodadost, A. and Movahed, R. 2008.

Determination of fecundity of *Chalcalburnus chalcoides* migrating to the Anzali Lagoon. Journal of Lahijan Biological Sciences, 2(2):11-17. In Farsi.

Rahbar, M., Khara, H., Ahmadnezhad, M., Khodadoust, A., Samadi, M., Hayatbakhsh, R. and Movahed, R. 2009. A comparison of fecundity in shemaya (*Alburnus chalcoides*, Guldenstaedt 1772) immigrant to the Anzali Wetland, Sefidrood, Chamkhaleh and Shirood rivers. Journal of Fisheries, 3(2):73-82. In Farsi.

Rahbar, M., Khara, H. and Khodadoust, A. 2013. Investigation of fecundity and its relationship with some growth indices of *Alburnus chalcoides* (Guldenstaedt, 1772) immigrant to Sefidrood, Chamkhaleh and Shirood Rivers, northern Iran. World Journal of Fish and Marine Sciences, 5(4):453-456.

Rahbar, M., Khara, H., Khodadoust, A. and Abbaspour, R. 2013. Fecundity and gonadosomatic index of *Alburnus chalcoides* (Güldenstaedt, 1772) immigrant to Anzali Wetland, Guilan Province, northern Iran. World Journal of Fish and Marine Sciences, 5(4):449-452.

Rahbar, M., Khoshkholgh, M., Farasati, S. and Zahmatkesh, F. 2021. Necessity of use Next-Generation Sequencing (NGS) technology in preserving native stocks. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Rahbari, S. and Razavilar, V. 1982. Saprolegniosis of goldfish (Carassius auratus) in Iran. Journal of the Veterinary Faculty of the University of Tehran, 38(1):55-62. In Farsi.

Rahdar, M., Mesbah, M. and Vazirian Zadeh, B. 2012. Detection of internal and external zoonosis parasites in *Barbus sharpeyi* in Shadegan and Sosangerd City during 2007. Jundishapur Journal of Health Sciences, 4(1):49-56. In Farsi.

Rahdari, A. and Gharaei, A. 2012. Length-weight relationship of two fish species *Schizothorax zarudnyi* and *Schizocypris altidorsalis* (Cyprinidae) from the Sistan Basin, Iran. The 17th National and 5th International Iranian Biology Conference, Shahid Bahonar University, Kerman, 4-6 September 2012. 4 pp.

Rahdari, A., Gharaei, A. and Ghaffari, M. 2014. Spawning latency period in hormonal induced reproduction of snow trout (*Schizothorax Zarudnyi* (*sic*) (Nikolskii, 1897)). Iranian Journal of Biotechnology, 12(1):61-65.

Rahdari, A., Gharaei, A., Ghaffari, M. and Najafi, T. 2013. Biotechnics of artificial propagation in *Schizothorax zarudnyi*. Iranian Aquaculture Society Journal, 1(1):73-82. In Farsi.

Rahdari, A., Gharaei, A., Ghaffari, M. and Pakzad, S. 2013. Effect of dietary lipid levels on growth, survival and serum metabolites of snow trout (*Schizothorax zarudnyi*) fingerlings. Iranian Aquaculture Society Journal, 1(2):41-52. In Farsi.

Rahdari, A., Khosravanizadeh, A. and Pakzad Toochai, A. 2021. Comparison of blood and semen composition of snow trout *Schizothorax zarudnyi* broods during reproduction season. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 11 pp. In Farsi.

Rahemo, Z. I. F. 1995. Studies on the parasites of *Garra rufa* Heckel, 1843 (Pisces: Cyprinidae). Rivista di Parassitologia, 12(2):273-278.

Rahemo, Z. I. F. 2011. Parasitic fauna of the freshwater fish (arath) *Acanthobrama marmid* caught from River Tigris passing through Mosul City, Iraq. VIII International Symposium of Fish Parasites, 26-30 September 2011, Viña del Mar, Chile (abstract).

Rahimabadi, E. Z., Mirdar, J., Elahi, M. Y., Arshadi, A. and Haidari, M. R. 2009. The lipid

quality assessment of *Schizothorax zarudnyi* and *Schizocypris altidorsalis* by fatty acid analysis. Pakistan Journal of Biological Sciences, 12(15):1090-1093.

Rahimi, A. E. K., Boustani, F., Tabiee, O. and Hashemi, M. 2011. An assessment of water pollution of the Beshar River aquatic ecosystem. Journal of Environmental, Ecological, Geological and Geophysical Engineering, 5(2):74-77.

Rahimi, E., Jahanmard, M. J., Safari, S., Ansari, M. and Torki, Z. 2016. Prevalence and antimicrobial resistance of *Listeria* species isolated from filleted *Argyrosomus hololepidotus, Scomberomorus commerson* and *Alburnus* spp. Journal of Food Microbiology, 3(3):1-9. In Farsi.

Rahimi, E. and Raeisi, M. 2009. Determination of lead and cadmium residual in meat of fishes caught from Choghakhor Lagoon in Chaharmahal and Bakhtiary Province. Iranian Veterinary Journal, 4(4)(21):79-83. In Farsi.

Rahimi, S., Shariati, F. and Khara, H. 2018. The effects of trout farm effluents on some water quality parameters of Khalkai River, Masal, Guilan. Journal of Animal Environment, 10(3):167-174 In Farsi.

Rahimi, S. and Tabiee, O. 2013. Analysis of fish faunas in Kaftar Wetlands: A case study of Fars Province (Iran). International Journal of Agriculture and Crop Sciences, 6(6):338-341.

Rahimi Bashar, M. R., Tehranifard, A., Ghaseminezhad, A., Alipour, V. and Falahchai, M. M. 2008. Determination of some hematological parameters on kutum (*Rutilus frisii kutum*) and their changes in different stages of gonad growth and spawning migration from the sea to river. Journal of Biology Science, 1(3)(series no. 3):45-56. In Farsi.

Rahimibashar, M., R., Joiende, N., Tagheipour Kouhbane, Sh., Torabi Jafroudi, H. and Farshchi, M. 2016. Age and growth of *Capoeta capoeta gracilis* in Shafaroud River of Guilan Province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Rahimibashar, M. R., Seaferihani, M. R., Torabi Jefroudi, H., Rasta, M., Khodadoust, A. and Tagheipour, S. 2016. Water quality and macrozoobenthos communities production potential in the Aharchai river (Eastern Azerbaijan). Journal of Animal Environment, 8(2):151-158. In Farsi.

Rahimibashar, M. R., Tagheipour Kouhbane, S., Jouyande, N. and Torabi Jafroudi, H. 2017. Diet and feeding indexes (*sic*) of *Capoeta razii* in the Shafarood River) Guilan Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Rahimikia, E., Vali, S., Akbary, P. and Jahanbakhshi, A. 2016. Determination of lethal concentration of mercuric chloride ($HgCl_2$), lead chloride ($PbCl_2$) and zinc chloride ($ZnCl_2$) in silver carp (*Hypophthalmichthys molitrix*). Journal of Experimental Animal Biology, 5(1):23-29. In Farsi.

Rahmani, A. R. and Ehsani, H. R. 2006. Application of ion exchange and air stripping methods to remove ammonium in recirculation fish culture system effluents. Iranian Scientific Fisheries Journal, 15(2):19-28. In Farsi.

Rahmani, F., Jafaryan, H., Ebrahami, P. and Ghiasi, M. 2012. The effects of *B. licheniformis* and *B. laterosporus* on the growth parameters in common carp (*Cyprinus carpio*) larvae. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 566-570.

Rahmani, F., Jafaryan, H., Ebrahimi, P. and Jafaryan, S. 2013. The role of probiotic Bacillus on

the biochemistry factors of body extract in common carp *Cyprinus carpio* larvae. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Rahmani, H. 2006. Population dynamics and genetic variation of shemaya, *Chalcalburnus chalcoides* (Guldenstadt, 1772) in Haraz, Shirud and Gazafrud rivers. Ph.D. Thesis, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan. 102 pp. In Farsi.

Rahmani, H. 2008. A study on populations of endangered species, shemaya, *Chalcalburnus chalcoides* in the Haraz and Shirud rivers. Journal of Environmental Studies, 34(46):129-138. In Farsi.

Rahmani, H. and Abdoli, A. 2008. Inter-population morphological diversity in *Vimba vimba persa* (Pallas, 1815) in Gorganrud River, Shirud river and Anzali Lagoon. Journal of Agricultural Sciences and Natural Resources, 15(1):28-37. In Farsi.

Rahmani, H. and Hasanzadeh Kiabi, B. 2006. Inter-population morphological diversity in *Chalcalburnus chalcoides* (Gueldenstaedt, 1772) in Haraz and Gazafrud rivers. Environmental Sciences, 3(10):21-33. In Farsi.

Rahmani, H., Hasanzadeh Kiabi, B., Kamali, A. and Abdoli, A. 2007. A study of morphological analysis of *Chalcalburnus chalcoides* (Gueldenstaedt, 1772) in Haraz River and Shirud River. Journal of Agricultural Sciences and Natural Resources, 14(3):40-50. In Farsi.

Rahmani, H. and Imanpour Namin, J. 2021. Study and conservation of freshwater habitats in the southern Caspian Sea basin. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Rahmani, H., Janikhalili, K. and Anvarifar, H. 2013. Biodiversity of fishes in Tajan River (Mazandaran Province). Journal of Fisheries (Iranian Journal of Natural Resources), 66(1):41-48. In Farsi.

Rahmani, H. and Kamali Pashakolai, E. 2017. Intra- and inter- population comparison of morphological characteristics of Caspian vimba *Vimba persa* (Pallas 1814) in the southern Caspian Sea. Journal of Applied Ichthyological Research, 5(3):43-54. In Farsi.

Rahmani, H., Kamali Pashakolai, E. and Patimar, R. 2011. A survey of biological characteristics of *Vimba vimba* in Gorganrud River and coastal waters of the Caspian Sea in Mahmoudabad. Journal of Fisheries (Iranian Journal of Natural Resources), 64(3):259-268. In Farsi.

Rahmani, H., Kazemi, B. and Pourkazemi, M. 2012. Comparison of genetic diversity of cytochrome b gene of shemaya (*Alburnus chalcoides*) in Haraz, Shirud and Gazafrud rivers by PCRRFLP method. Modern Genetics Journal, 7(1)(28):65-70 (and 7(3)(30):227-232). In Farsi.

Rahmani, H., Kazemi, B. Pourkazemi, M., Bandehpour, M., Naderi, J. M., Seyed, N. and Ataei, F. 2009. Genetic diversity of the shemaya (*Chalcalburnus chalcoides*) populations in Haraz, Shirud and Gazafrud rivers using 18S RRNA gene and PCR-RFLP method. Environmental Sciences, 6(3):43-52. In Farsi.

Rahmani, H., Kiabi, B., Kamali, A. A. and Abdoli, A. 2009. Some biological characteristics of shemaya *Chalcalburnus chalcoides* in Shirud River. Journal of Agricultural Sciences and Natural Resources, 16(3):67-76. In Farsi.

Rahmani, H., Kiabi, B. H. and Abdoli, A. 2011. Age, growth and reproduction characteristics of *Vimba vimba persa* in south-east of Caspian Sea (Iran). Journal of Fisheries International,

6(2):46-51.
Rahmani, I. and Golmohamaddi, G. H. 1991. A study of absolute fecundity of roach, *Rutilus rutilus caspicus*, in Gorgan-Rud River. B.Sc. Project, University of Gorgan, Gorgan. In Farsi.
Rahmani Khanqahi, F., Omidzahir, S., Movahedinia, A. and Akhoundian, M., 2020. Determination of median lethal concentration of herbicide bensulfuron methyl in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 29(2):65-72. In Farsi.
Rahmanifarah, K., Moloudi, Z., Moeini, S., Shaabanpour, B. and Imanpour, M. R. 2010. Effects of CO_2, clove oil stunning procedure and asphyxiation meat quality in common carp (*Cyprinus carpio*). Journal of Veterinary Research, 65(4):301-306. In Farsi.
Rahmanikhah, Z., Esmaili-sari, A. and Bahramifar, N. 2020. Total mercury and methylmercury concentrations in native and invasive fish species in Shadegan International Wetland, Iran, and health risk assessment. Environmental Science and Pollution Research, 27(7):6765-6773.
Rahmati, R., Azari Takami, Gh. and Yahyavi, M. 2013. The effects of enriched *Artemia* with unsaturated fatty acid and vit. C feeding of gold fish larvae for determination of anti-stress factors. Journal of Aquatic Animals and Fisheries, 3(12):37-43. In Farsi.
Rahmati-Holasoo, H., Ahmadivand, S., Shokrpoor, S. and El-Matbouli, M. 2020. Detection of carp pox virus (CyHV-1) from koi (*Cyprinus carpio* L.) in Iran: clinic-pathological and molecular characterization. Molecular and Cellular Probes, 54:101668.
Rahmati-holasoo, H. and Ebrahimzadeh Mousavi, H. A. 2011. Letter to the Editor. Iranian Journal of Parasitology, 6(4):109-111.
Rahmati-holasoo, H., Ebrahimzadeh Mousavi, H. A., Ahmadpoor, M., Amiri, F., Toyneghli, R. and Bahalkeh, A. 2014. Checking metaserker (*sic*) *Postodiplostomum* (*sic*) distribution in *Alburnoides eichwaldii* in the Zaringol River of the Golestan Province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Rahmati-Holasoo, H., Hadadi, A., Azizi, A. and Mohammadian Rasanani, A. 2018. Study of contamination of external parasites in goldfish of Alborz Province. Iranian Journal of Veterinary Medicine, Supplementary Issue, 12(5):64.
Rahmati-holasoo, H., Hajimohammadi, B., Ahmadiara, E., Ebrahimzadeh Mousavi, H., Rostami-bashman, M., Haghighi Khiabanain Asl, A., Sohrabi Haghdoost, I., Shokrpour, S. and Ghorbanalipour, A. 2011. A study of infestation of *Alburnoides bipunctatus* with *Ligula intestinalis* in Latian reservoir Dam Lake, Tehran province, Iran: A histopathological study. HVM Bioflux, 3(1):18-24.
Rahmati-holasoo, H., Mirzargar, S. S., Amiri, F., Toyneghli, R. and Ahmadpoor, M. 2014. The study of clove oil’s shelf-life time in the fish anesthetic. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Rahmati-holasoo, H., Vajhi, A., Davoudipoor, S., Toyneghli, R., Ahmadpoor, M. and Harmabadi, B. T. 2014. A study on skeletal abnormalities of goldfish (*Carassius auratus*) in the spring of Hamedan Pirhayati village using digital radiography images. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Rahmati-Holasoo, H., Zargar, A., Ahmadivand, S., Shokrpoor, S., Ezhari, S. and Ebrahimzadeh

Mousavi, H. A. 2016. First detection of koi herpesvirus from koi, *Cyprinus carpio* L. experiencing mass mortalities in Iran: clinical, histopathological and molecular study. Journal of Fish Diseases, 39(10):1153-1163.

Rahmatipour, R., Roomiani, L. and Askary Sary, A. 2017. Effect of different packaging on shelf life of silver carp (*Hypophthalmichthys molitrix*) fillets stored at 4ºC. Iranian Journal of Aquatic Animal Health, 3(2):22-35. In Farsi.

Rahmatizadeh, M. H. 2008. Processing of oil enriched fish (Hypophthalmichthys molitrix) sausage using emulsion technology. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 129 pp. In Farsi.

Rahmdel, K. J., Allaf Noverian, H., Falahatkar, B. and Babakhani, A. 2016. Effect of fish meal replacement with sunflower meal on growth, hematological indices and plasma biochemistry of common carp (*Cyprinus carpio*) fingerlings. Aquatic Physiology and Biotechnology, 4(1):49-68. In Farsi.

Rahmdel, K. J., Allaf Noverian, H., Falahatkar, B. and Babakhani Lashkan, A. 2018. Effect of replacing fish meal with sunflower meal on growth performance, body composition, hematological and biochemical indices of common carp (*Cyprinus carpio*) fingerlings. Fisheries and Aquatic Life, 26(2):121-129.

Rahnama, B., Akrami, R. and Chitsaz, H. 2013. The effects of dietary inulin on the growth performance, survival, body composition and resistance against stress of gibel carp juvenile (*Carassius auratus gibelio*). Breeding and Aquaculture Sciences Quarterly, 1(2):55-70. In Farsi.

Rahnama, B., Kamrani, E., Abdoli, A., Naji, A. and Raeisi, H. 2019. The growth and mortality of Roach (*Rutilus rutilus caspicus*,Yakovlev,1870) in the southern waters of the Caspian Sea (Golestan province). Journal of Animal Environment, 11(3):181-190. In Farsi.

Rahnama, H. and Somogyi, S. 2020. Northern Iranian consumers' motivation for seafood choice. Journal of International Food and Agribusiness Marketing, 32(5):441-463.

Rahnama, M., Khedri, J., Ahmadzadeh, N., Jamshidian, A., Sattari, A. and Bamorovat, M. 2017. A survey on the prevalence and histopathological findings of *Lernaea* spp. in *Schizocypris altidorsalis* from Chahnimeh lakes and Hamoun wetland in southeast Iran. Istanbul Üniversitesi Veteriner Fakültesi Dergisi, 43(1):19-22.

Rahnama, M., Khedri, J., Sedaghati Mokhtari, M., Jamshidian, A., Shafiian, A. and Bamovorat, M. 2016. Prevalence and histopathologic study of *Lernaea* spp. (Maxillopoda: Lernaeidae) in *Cyprinus carpio* fish in Sistan and Baluchestan, southeast Iran. Scientia Parasitologica, 17(1-2):43-48.

Rahnama, R., Tulaby Dezfuly, Z. and Peyghan, R. 2017. Report of Lerneasis in *Chenopharyngodon* (*sic*) *idella* in Khuzestan province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 149-152. In Farsi.

Rahnama, S., Yelghi, S. and Shajiee, H. 2012. Investigation on some of the biological characters of brooders of *Cyprinus carpio* L., 1758 on the Bandar Turkmen fish hatchery center. Journal of Fisheries, 6(3):111-120. In Farsi.

Rahpayma, M., Haghighi Karsidani, S. and Ghasemi, M. 2017. In vitro culture of spleen cells of *Rutilus kutum*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Raiatpishe, M. K., Mohebbi, S., Moradkhani, Z. and Mousavi, H. 2009. Study on ovulation with injection of GnRHa and CPE on goldfish *Carassius auratus*. Asian Pacific Aquaculture

2009, 3-6 November 2009, Kuala Lumpur, Malaysia (abstract).
Raiatpishe, M. K., Mousavi, H., Mohebbi, S. and Marjani, M. 2009. Effectiveness of the gonadotropin hormone and carp pituitary extract (CPE) on spawning success, fecundity, and fertilization success in goldfish (*Carassius auratus*). Aquaculture Europe 2008, 14-17 August 2009, Trondheim, Norway (abstract).
Rainboth, W. J. 1981. Systematics of the Asiatic barbins (Pisces, Cyprinidae). Ph.D. Thesis, University of Michigan. ix + 253 pp.
Rais Azizi, M., Gharaei, A. and Ghaffari, M. 2013. Investigation of phylogenetic relationship of Barbinae species in south of Iran. Modern Genetics Journal, 8(3)(34):313-320. In Farsi.
Raiss-Tousi, A. 1999. Caspian Sea ecology at risk, Iranian expert warns. Sea Wind, 13(4):21-22.
Raissy, M. and Ansari, M. 2012. Parasites of some freshwater fish from Armand River, Chaharmahal va Bakhtyari Province, Iran. Iranian Journal of Parasitology, 7(1):73-79.
Raissy, M., Ansari, M. and Jalali, B. 2009. Identification of parasites of three *Capoeta* spp. in Kyar and Beheshtabad rivers, Chaharmahal & Bakhtyari Province and first report of *Lamproglena chinensis* Yu, 1937 in Iran. Journal of Veterinary Pathobiology, 1(1):18-22. In Farsi.
Raissy, M., Ansari, M., Lashkari, A. and Jalali, B. 2010. Occurrence of parasites in selected fish species in Gandoman Lagoon, Iran. Iranian Journal of Fisheries Sciences, 9(3):464-471.
Raissy, M., Ansari, M. and Jalali, B. 2010. Parasites of three species of *Capoeta* spp. from Beheshtabad River, Iran. Journal of Veterinary Pathobiology, 1(1):38-43. In Farsi.
Raissy, M., Ansari, M., Moumeni, M., Goudarzi, M. A., Sohrabi, H. R. and Rashedi, M. 2010. An epizootic of *Ichthyophthiriasis* among fishes in Armand River, Iran. Journal of Cell and Animal Biology, 4(10):151-153.
Raissy, M., Ansari, M., Yousefpour, S., Fadaeifard, F. and Mehdipour, M. 2009. Investigation of outbreak of *Lernaea cyprinacea* Linnaeus, 1758 (Crustacea: Copepoda) in fish from Choghakhor Lagoon. Veterinary Research Bulletin, 6(2):129-134. In Farsi.
Raissy, M., Azizi, H., Fadaeifard, F. and Yousef Pour, S. 2013. Parasites of some native fish from Kaaj River, Chaharmahal va Bakhtiari Province, Iran. World Journal of Fish and Marine Sciences, 5(1):84-87.
Raissy, M., Barzegar, M., Alimardani, K. and Jalali, B. 2006. Parasites of gills of 8 fish species in Choghakhor lagoon and introducing *Dactylogyrus spiralis* in Iranian common carp. Iranian Journal of Veterinary Sciences, 1(3):411-418. In Farsi.
Raissy, M., Barzegar, M. and Jalali, B. 2007. Parasites of native and introduced fishes in Choghakhor Lagoon, Iran. World Aquaculture Society, San Antonio, Texas, February 26 - March 2, 2007 (abstract).
Raissy, M., Barzegar, M., Jalali, B. and Alimardani, K. 2006. A survey on monogenean parasites of gills of fishes in Chaghakhor Lake and introducing *Dactylogyrus spiralis*. Iranian Journal of Veterinary Science, 1(3):411-418.
Raissy, M., Barzegar, M., Rahimi, E. and Jalali, B. 2008. Identification of worm parasites of fishes in Choghakhor Lagoon, Iran. In: Sengupta, M. and Dalwani, R. (Eds.). Proceedings of Taal 2007: The 12th World Lake Conference, 28 October-2 November 2007, Jaipur, Rajasthan, pp. 2177-2180.
Raissy, M., Doosti, A. and Ansari, M. 2009. Cloning and sequencing of Its-1 region of the parasite *Tylodelphys clavata* (Von Nordman 1832). World Applied Sciences Journal, 7(3):355-357.
Raissy, M., Fadaeifard, F., Ansari, M., Tajizadegan, H. and Hosseini, R. 2010. Parasites of fish

in Sooleghan Lagoon. Veterinary Journal of Islamic Azad University, Garmsar Branch, 5(1):143-148. In Farsi.

Raissy, M., Keyhani, K. and Pirali, K. 2020. Comparison of the effects of geranium, lavender and garlic extracts on *Ichthyophthirius multifilis* in naturally infected *Capoeta damascina*. Journal of Animal Environment, 12(4):307-310. In Farsi.

Raissy, M., Rahimi, E., Ansari, M. and Ebadi, A. G. 2010. Determination of mercury and arsenic levels in fish caught in the Beheshtabad River, Chaharmahal and Bakhtiari Province, Iran. Toxicological and Environmental Chemistry, 92(9):1627-1631.

Raissy, M., Sohrabi, H. R., Rashedi, M. and Ansari, M. 2013. Investigation of a parasitic outbreak of *Lernaea cyprinacea* Linnaeus (Crustacea: Copepoda) in cyprinid fish from Choghakor lagoon. Iranian Journal of Fisheries Sciences, 12(3):680-688.

Rajabi Islami, H., Arab, N. and Darvishi, S. 2017. Relationship between sperm parameters and morphological characteristics of males kutum (*Rutilus kutum*) in the southwestern Caspian Sea. Journal of Animal Environment, 8(4):149-156. In Farsi.

Rajabi Nejad, R. 2001. Study of growth, feeding and reproduction of (*Alburnus chalcoides*, Guldenstaedt 1772) in the Sefidrood River. M.Sc. Thesis, Islamic Azad University of Lahijan, Iran.

Rajabi Nezhad, R. and Azari Takami, G. 2009. A study of feeding habits of Caspian shemaya (shah-koolee) *Chalcalburnus chalcoides* (Guldenstadt, 1772) in the Sefidrood River. Journal of Marine Biology, 1(1):45-63. In Farsi.

Rajabiesterabadi, H., Ghelichi, A., Jorjani, S., Hoseini, S. M. and Akrami, R. 2019. Dietary olive (*Olea europaea*) leaf extract suppresses oxidative stress and modulates intestinal expression of antioxidant- and tight junction-related genes in common carp (*Cyprinus carpio*). Aquaculture, 520:734676.

Rajabiesterabadi, H., Hoseini, S. M., Fazelan, Z., Hoseinifar, S. H. and Van Doan, H. 2020. Effects of dietary turmeric administration on stress, immune, antioxidant and inflammatory responses of common carp (*Cyprinus carpio*) during copper exposure. Aquaculture Nutrition, 26(4):1143-1153.

Rajabiesterabadi, H., Yousefi, M. and Hoseini, S. M. 2020. Enhanced haematological and immune responses in common carp *Cyprinus carpio* fed with olive leaf extract-supplemented diets and subjected to ambient ammonia. Aquaculture Nutrition, 26(3):763-771.

Rajaei, G., Mansouri, B., Jahantigh, H. and Hamidian, A. H. 2012. Metal concentrations in the water of Chahnimeh reservoirs in Zabol, Iran. Bulletin of Environmental Contamination and Toxicology, 89(3):495-500.

Rakhodaei, M., Alishahi, M. and Baboli, M. J. 2012. Determining the lethal concentration of diazinon pesticide (LC50 96 H) on *Barbus grypus*. World Journal of Fish and Marine Sciences, 4(4):390-395.

Rakhshadi, V., Maleki, S., Mahmoudi, S., Moradi, M. R, A., Pourmalaye, N., Kadkhodiae, M. and Abtin, A. 2016. Determining the area with high protection priority in Jazmourian wetland using remote and multi criteria evolution method with FUZZY logic. Journal of Wetland Ecobiology, 8(3):69-84. In Farsi.

Rakhshani, M., Mirdar Harijani, J. and Gharaei, A. 2018. Investigating the anesthetic vigor and histopathological effects of peppermint (*Mentha piperita*) essential oils in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 27(1):1-10. In Farsi.

Rakhshi, N., Olsson, H. and Nikravesh, A. 2013. The effects of copper sulfate as a pollutant on

sexual behavior of Gold fish (Cyprinidae: *Carassius auratus*). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 47 (abstract).

Raki, M., Heyrati, F. P. and Dorafshan, S. 2015. Effect of colloidal silver nanoparticles and silver nitrate on hematological indices of Zayandehrud chub (*Petroleuciscus esfahani*). Journal of Aquatic Ecology, Hormozgan University, 5(3):114-123. In Farsi.

Raki, M., Heyrati, F. P. and Dorafshan, S. 2015. Histopathological lesions in gill and liver tissues of Zayandehrud chub *Petroleuciscus esfahani* Coad & Bogutskaya, 2010 after exposure to water-borne silver nanoparticles or silver nitrate. Journal of Applied Ichthyology Research, 4(4):79-95. In Farsi.

RaLonde, R. 1970. Report of the Nahang Roga migration study. Report of the Fisheries Research Institute, Bandar Pahlavi. MS.

RaLonde, R., Kinunen, W. and Walczak, P. 1970. Sardab River survey. Division of Research and Development, Iran Game and Fish Department, Tehran. MS.

RaLonde, R. and Razavi, B. 1972. The growth of the whitefish Rutilus frisii kutum of the southern Caspian Sea. Report of the Fisheries Research Institute, Bandar Pahlavi. MS.

RaLonde, R. and Walczak, P. 1970a. Stock assessment and composition of the commercial bony fishes of the southern Caspian Sea. Report of the Fisheries Research Institute, Bandar Pahlavi. 40 pp.

RaLonde, R. and Walczak, P. 1970b. Summary of the fisheries of Iran. Report of the Fisheries Research Institute, Bandar Pahlavi. MS, 9 pp., 5 tabs.

RaLonde, R. and Walczak, P. 1970c. Report on Lar River survey. Report of the Fisheries Research Institute, Bandar Pahlavi. MS, 11 pp., 5 tabs., 3 figs.

RaLonde, R. and Walczak, P. 1971a. Stock assessment and composition of the commercial bony fishes of the southern Caspian Sea. Report of the Fisheries Research Institute, Bandar Pahlavi. 76 pp.

RaLonde, R. and Walczak, P. 1971b. A short report on net selection of the Shilot beach seines. Report of the Fisheries Research Institute, Bandar Pahlavi. MS.

RaLonde, R. and Walczak, P. 1972. A review of Shilot's bony fishing policy from 1929-1972. Report of the Fisheries Research Institute, Bandar Pahlavi. MS, 10 pp., 3 tabs., 9 figs.

Rameshgar, M., Ghomi Marzdashti, M. R., Hashemi Karoui, S. M., Hoseini Fard, S. M. and Tabari Pour, S. R. 2020. Isolation, characterization and molecular identification of potential probiotic lactobacilli from gastrointestinal tracts of *Capoeta razii* and *Aristichthys nobilis*. International Journal of Aquatic Biology, 8(6):396-403.

Ramezani, H. 2014. The possibility production of food pellets for common carp (*Cyprinus carpio*) in the rearing stage with emphasis on attractiveness and strength. Iranian Fisheries Science Research Institute, Tehran. 40 pp. In Farsi.

Ramezani, H. 2016. Evaluate the impact of dietary herbal appetizer on the growth performance of growth out common carp (*Cyprinus carpio*). Iranian Fisheries Science Research Institute, Tehran. 28 pp. In Farsi.

Ramezani, H., Fazli, H. and Hafezieh, M. 2016. Evaluate the impact of dietary herbal appetizer on the growth performance of grow out common carp *Cyprinus carpio* (Linnaeus, 1758). Journal of Animal Environment, 8(1):195-200. In Farsi.

Ramezani, S. and Hashemi, S. H. 2014. Analysis of water quality in Helleh River basin using multivariate factor analysis. Iranian Water Research Journal, 8(14):119-126. In Farsi.

Ramin, M. 1997a. Artificial breeding of *Abramis brama orientalis*. Iranian Fisheries Scientific

Journal, 6(1):23-32, 4. In Farsi.
Ramin, M. 1997b. Indentification (*sic*) of Babolrud River's fish fauna. Iranian Fisheries Scientific Journal, 6(3):59-72, 8. In Farsi.
Ramin, M. 2009a. Identification and distribution of *Barbus* species of Iran by radiography technique and morphometric methods. Ph.D. Thesis, Islamic Azad University. 172 pp. In Farsi.
Ramin, M. 2009b. A survey on ichthyofauna of Karkheh River basin. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 150 (abstract).
Ramin, M. 2015. Study of site selection for carp and trout fish species for responsible aquaculture possibility. Iranian Fisheries Science Research Institute, Tehran. 33 pp. In Farsi.
Ramin, M., Bagheri, S., Moradi, M., Abbasi, K., Mirzajani, A. and Doustdar, M. 2016. Identification, distribution, abundance and species composition of fish in the Chitgar Lake (Tehran Province of Iran). Iranian Journal of Fisheries Sciences, 15(1):585-589.
Ramin, M. and Dostdar, M. 2015. A morphometric and meristic study on *Luciobarbus brachycephalus* and *Luciobarbus capito*. Journal of Marine Biology, 7(1):7-14. In Farsi.
Ramin, M. and Doustdar, M. 2012a. Status of threatened and endangered fish species of inland water resources of Iran. Second Conference of Agricultural Sciences, Basrah, Iraq (abstract).
Ramin, M. and Doustdar, M. 2012b. A survey on ichthyofauna of Dez River basin in Iran. Second Conference of Agricultural Sciences, Basrah, Iraq (abstract).
Ramin, M. and Doustdar, M. 2017a. Morphometric and meristic comparison between two similar species of *Luciobarbus barbulus* (Heckel, 1847) and *Luciobarbus pectoralis* (Heckel, 1843). Iranian Journal of Fisheries Sciences, 16(1):451-456.
Ramin, M. and Doustdar, M. 2017b. Introducing and determination abundance of invasive and alien fishes of Chitgar Lake. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 722-727. In Farsi.
Ramin, M. and Doustdar, M. 2017c. A survey on biodiversity of Cyprinid fishes of Iran. Iranian Fisheries Science Research Institute, Tehran. 61 pp. In Farsi.
Ramin, M., Doustdar, M. and Owfi, F. 2018. *Capoeta buhsei* Kessler, 1877 the only endemic species of Lake Chitgar. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Ramin, M., Doustdar, M., Owfi, F. and Lakzaie, F. 2014. Ichthyofauna of Gahar Lake and Gahar River, Lorestan Province, Iran. Iranian Journal of Fisheries Sciences, 13(4):886-894.
Ramin, M., Ghasemi, Sh., Dostar, M., Moradi, M., Abbasi, K., Bagheri, S., Khatib, S. and Norozi, H. 2017. Survey on identification and abundance of fishes in the Chitgar Lake. Iranian Fisheries Science Research Institute, Tehran. 74 pp. In Farsi.
Ramin, M. and Owfi, F. 2008. A survey of ichthyofauna of Dez River basin. Twenty-Eighth Pakistan Congress of Zoology (International), Government College, Faisalabad, 18-20 March 2008 (abstract).
Ramin, M., Shiri, S. and Doustdar, M. 2012. Ichthyotoxism in *Capoeta capoeta gracilis* (Keyserling, 1861) from west of Urmia (Marmisho Lake), Iran. Iranian Journal of Fisheries Sciences, 11(1):223-225.
Ramin M., Valinassab T., Dostdar M. and Jamili Sh. 2018. Management of genetic resources vertebrates in the inland waters of Iran. Iranian Fisheries Science Research Institute. 45 pp. In Farsi.

Ramzani, H., Farabi, S. M. V. and Hafezieh, M. 2012. The rearing of common carp (*Cyprinus carpio*) in the fiber glass tank with pellet. Journal of Fisheries, 6(1):165-172. In Farsi.
Ramzani, H., Fazli, H. and Hafezieh, M. 2014. The possibility of production of food pellets for common carp (*Cyprinus carpio*) in the rearing stage with emphasis on attractiveness and strength. Journal of Animal Environment, 6(1):77-84. In Farsi.
Rana, K. and Bartley, D. M. 1998. Iran promotes aquaculture development. FAO Aquaculture Newsletter, 19:26-30.
Ranjdoust, M., Jafarian, H., Hersij, M. and Gholipour, K. 2016. The effects of transportation on biochemical and hematological parameters of the common carp (*Cyprinus carpio* L.) juvenile in using Celmanax liquid yeast by supplementation in diet. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Ranjdoust, M., Jafaryan, H., Harsij, M. and Gholipour Kanaani, H. 2018. Effect of celmanax prebiotic on blood parameters of common carp (*Cyprinus carpio* Linnaeus, 1758) in transport stress. Journal of Animal Environment, 9(4):207-214. In Farsi.
Ranjdoust, M., Jafaryan, H., Harsij, M. and Gholipour Kanaani, H. 2019. The effect of celmanax prebiotic and five probiotic bacilli species on the decreasing of stress of common carp (*Cyprinus carpio* Linnaeus, 1758) during transportation with different salinity. Journal of Aquaculture Sciences, 6(2):39-50. In Farsi.
Raoofi, P., Ojagh, S. M., Shabanpour, B. and Eighani, M. 2015. Effects of catching methods on quality changes of *Rutilus kutum* (Kamensky, 1901) during storage in ice. Journal of Applied Ichthyology, 31(4):729-732.
Raoufi, P., Jafaryan, H., Patimar, R. and Ghorbani, R. 2018. Impact of common carp cage culture on the community structure of zooplanktons in the Golestan reservoir. Journal of Animal Environment, 10(4):291-300. In Farsi.
Raoufi, P., Ojagh, S. M., Shabanpoor, B. and Yahyaei, M. 2015. Effects of delayed icing on quality characteristics of *Rutilus frisii kutum*. Iranian Journal of Food Science and Technology, 12(49):21-30. In Farsi.
Raoufinia, G. 2011. Assessment of copper sulfate on digestive enzyme activity in common carp (*Cyprinus carpio*). M.Sc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources. 56 pp.
Rasekhifar, Kh. 1998. Effects of application of Baclofen (agonist receptor GABA-B) alone and in combination with LHRH-A Metacloperamid and the release of GTH-I in carp (*Cyprinus carpio*). M.Sc. Thesis, University of Tarbiat Moalem, Tehran. 120 pp.
Rashidi, A. A., Mirdavarjijani, J., Gharasi, A. and Hemayounpour, M. 2017. Effect of *Utrica dioica* on serum liver enzymes of common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 432-436. In Farsi.
Rashidi, Z., Khara, H. and Mousavi-Sabet, H. 2012. Hematological profile of the mature *Rutilus frisii kutum* (Cyprinidae) migrated to the Tajan River in the southern Caspian Sea. World Journal of Fish and Marine Sciences, 4(6):665-671.
Rashki, A., Kaskaoutis, D., Rautenbach, C. J. deW. and Eriksson, P. 2012. Changes of permanent lake surfaces, and their consequences for dust aerosols and air quality: the Hamoun lakes of the Sistan area, Iran, pp. 163-202. In: Abdul-Razzak, H. (Ed.). Atmospheric Aerosols: Regional Characteristics - Chemistry and Physics. INTECH Open Access Publisher. 490 pp.
Rashki Ghaleno, O., Sayadi, M. H. and Rezaei, M. R. 2015. Potential ecological risk assessment

of heavy metals in sediments of water reservoir case study: Chah Nimeh of Sistan. Proceedings of the International Academy of Ecology and Environmental Sciences, 5(4):89-96.

Rashmeei, M., Hosseinie Shekerabi, S. P., Shamsaie Mehrgan, M. and Paknejad, H. (previous surname Kolangi Miandare). 2020. Stimulatory effect of dietary chasteberry (*Vitex agnus-castus*) extract on immunity, some immune-related gene expression, and resistance against *Aeromonas hydrophila* infection in goldfish (*Carassius auratus*). Fish and Shellfish Immunology, 107(Part A):129-136.

Rashmeei, M., Hosseinie Shekerabi, S. P., Shamsaie Mehrgan, M. and Paknejad, H. (previous surname Kolangi Miandare). 2021. Assessment of dietary chaste tree (*Vitex agnus-castus*) fruit extract on growth performance, hemato-biochemical parameters, and mRNA levels of growth and appetite-related genes in goldfish (*Carassius auratus*). Aquaculture and Fisheries, doi:10.1016/j.aaf.2021.01.007.

Rasouli, F., Kiani Pouya, A. and Cheraghi, S. A. 2012. Hydrogeochemistry and water quality assessment of the Kor-Sivand basin, Fars province, Iran. Environmental Monitoring Assessment, 184(4):4861-4877.

Rasouli, S. 2013. Prevalence of *Diplostomum spathaceum* infectious in some endemic fishes of water resources in West Azerbaijan Province. Iranian Scientific Fisheries Journal, 22(2):147-152. In Farsi.

Rasouli, S., Anvar, A. A., Ahari, H. and Khodadadi, A. 2011. Parasite survey in fishes of Marmisho Lake (*Argulus foliaceus* parasite). Journal of Comparative Pathobiology, 8(2):491-495. In Farsi.

Rasouli, S., Azadikhah, D. and Mohammad Pour, O. 2017. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 688-693. In Farsi.

Rasouli, S., Nekuifard, A., Azadikhah, D., Ahari, H., Anvar, A, A., Khodadadi, A. and Ghasemi, A. 2012. Ectoparasite infection of *Carassius carassius* in water resources of west Azerbaijan, Iran. Iranian Journal of Fisheries Sciences, 11(4):156-164, 160.

Rasta, M., Khodadoust, A., Khara, H. and Rahbar, M. 2011. Determine of some biometry and fecundity indices in female khramulia (*Capoeta capoeta gracilis* Keyserling 1861) in the Sefidroud River. Journal of Animal Environment, 3(2):41-48. In Farsi.

Rastegari, S., Hajimoradloo, A. and Kolangi Miandare, H. 2018. The effect of different levels of peppermint (*Mentha piperita*) powder on the growth parameters and some immune parameters of skin mucus in Caspian roach *Rutilus caspicus* (Yakovlev, 1870). Journal of Applied Ichthyological Research, 5(4):115-128. In Farsi.

Rastkari, N., Mesdaghinia, A., Yunesian, M. and Ahmadkhaniha, R. 2012. Butylin compounds in fish commonly sold in north of Iran. Bulletin of Environmental Contamination and Toxicology, 88(1):74-77.

Rasuli, S., Anvar, A. A., Ahari, H., Azadikhah, D. and Khodadadi, A. 2012. Survey *Diplostomum spathaceum* in eyes of *Carassius carassius* fish in Nazlo River of Urmia City. Journal of Comparative Pathobiology, 9(3)(38):743-748.

Rasuli, S. and Pourghasem, S. 2015. Evaluation the external parasites infection of carp fishes in Zarineh-rud River in Miandoab. Bulletin of Environment, Pharmacology and Life Sciences, 4(3):60-63.

Rawi, A. H. A., Obaidi, S. and Zaki, S. 1975. Preliminary list of fishes from the Little Zab River. Iraqi Science Conference, pp. 1-7 (abstract).

Raymakers, C. 2002. Study on the social and economic aspects of illegal fishing in the Caspian Sea. Caspian Environmental Programme, Baku, Azerbaijan. 47 pp., 17 annexes.

Razavi, B. 1992. Biology of mahi sefid *Rutilus frisii kutum* (Kamenskii, 1901). Iranian Fisheries Research Organization, Tehran. 158 pp. In Farsi.

Razavi, B. and Pour, N. H. 1979. Artificial spawning and culturing of *Rutilus frisii kutum* (Kamensky) in the year (1976-1977) 2535. Report of the Seminar on Fishery Technology Education July-August 1979, Tehran.

Razavi, B. A. 1999. Introduction to the Ecology of the Caspian Sea. Iranian Fisheries Research Organization, Tehran. 110 pp. In Farsi.

Razavi, S. 1991. Agrarian change in two regions of Kerman. Journal of the British Institute of Persian Studies, 29(1):161-179.

Razavi Pour, P., Eagderi, S. and Poorbagher, H. 2014. Study of osteological characteristics of tuini fish (*Capoeta damascina* Valenciennes, 1842) from Tigris basin. Journal of Applied Ichthyological Research, 2(3):1-16. In Farsi.

Razavi Pour, P., Eagderi, S., Poorbagher, H. and Keivany, Y. 2013. Comparison of body shape in five taxa of genus *Capoeta* in Iranian inland waters using geometric morphometric method. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 50 (abstract).

Razavi Pour, P., Eagderi, S., Poorbagher, H. and Keivany, Y. 2015. Phenotypic plasticity of the tuini fish, *Capoeta damascina* (Actinopterygii: Cyprinidae) populations in Iranian part of Tigris basin using geometric morphometric approach. Journal of Animal Researches (Iranian Journal of Biology), 28(2):170-179. In Farsi.

Razavi Sayad, B. 1993. Morphometric and electrophoresis genetic markers with blood serum in mahisefid (*Rutilus frisii kutum*). M.Sc. Thesis, Islamic Azad University, Tehran. 115 pp. In Farsi.

Razavi Sayad, B. 1995. Kutum fish. Iranian Fisheries Research Organization, Tehran. 165 pp. In Farsi.

Razavilar, V., Khani, M., R. and Motallebi, A. A. 2013. Bacteriological study of cultured silver carp (*Hypophthalmichthys molitrix*) in Gilan, province, Iran. Iranian Journal of Fisheries Sciences, 12(3):689-701.

Razavilar, V., Tabatabayi, A. H., Gharagozlou, M. J. and Djalali, B. 1981. The study of red-sore disease in grass carp (Ctenopharyngodon idella) in Iran. Journal of the Veterinary Faculty of the University of Tehran, 37(3):11-22. In Farsi.

Razavilar, V. and Tavakoli, H. R. 2006. A prevalence study of human toxigenic types of *Clostridium botulinum* (A, B, E) in some sea water fishes of northern (*Rutilus frisii kutum* and *Mugil auratus* Risso) and southern (*Otolithes ruber* and *Stromateus niger*) regions of Iran. Journal of Veterinary Research, 61(1):39-42. In Farsi.

Razavipoor, P., Eagderi, S., Poorbagher, H., Javanshir Khoie, A. and Keivani, Y. 2015. Comparative study of morphological characteristics of Tuini fish (*Capoeta damascina*) in inland water of Iran using geometric morphometric method. Journal of Fisheries, 68(1):79-90. In Farsi.

Razavipour, P. 2013. Taxonomy of Iranian tu'ini (*Capoeta damascina*) using morphological characters. M.Sc. Thesis, Department of Fisheries, University of Tehran. 106 pp.

Razi Jalali, M. H., Larki, S., Peyghan, R. and Bastami, M. 2020. Morphologic and molecular detection of *Dactylogyrus* species in *Cyprinus carpio* and *Ctenopharyngodon idella* in Southwestern Iran. Kocatepe Veteriner Dergisi, 13(3):241-247.

Razivi, B., RaLonde R. and Walczak, P. 1972. 1972 report on stock assessment and composition of the commercial bony fishes of the Southern Caspian Sea. Report of the Fisheries Research Institute, Bandar Pahlavi. 32 pp.

Redding, T. A. and Midlen, A. B. 1991. Fish production in irrigation canals. A review. Food and Agriculture Organization, Rome, Fisheries Technical Paper, 317:vii + 111 pp.

Regan, C. T. 1906. Two new cyprinoid fishes from the Helmand basin. Journal of the Asiatic Society of Bengal, new series, 2(1):8-9.

Reichenbacher, B., Alimohammadian, H., Sabouri, J., Haghfarshi, E., Faridi, M., Abbasi, S., Matzke-Karasz, R., Giuditta Fellin, M., Carnevale, G., Schiller, W., Vasilyan, D. and Scharrer, S. 2011. Late Miocene stratigraphy, palaeoecology and palaeogeography of the Tabriz Basin (NW Iran, Eastern Paratethys). Palaeogeography, Palaeoclimatology, Palaeoecology, 311(1-2):1-18.

Reid, G. Mc. 1982. The form, function and phylogenetic significance of the vomero-palatine organ in cyprinid fishes. Journal of Natural History, 16(4):497-510.

Rekabi, S. M., Rahmani, H., Abdollahpoor, Z., Poor Poode, S. E. and Hasani, M. 2014. Comparison of growth factors in European chub (*Squalius cephalus*) between Tajan and Siahrood River in Mazandaran province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Renaud, C. B. and Coad, B. W. 1997. Vadim D. Vladykov (1898-1986): Lampreys, Labels and Loans, pp. 553-557. In: Pietsch, T.W. and Anderson, W. D. (Eds.). Collection Building in Ichthyology and Herpetology. American Society of Ichthyologists and Herpetologists, Special Publication, 3:xiii + 593 pp.

Reshetnikov, Yu. S. 2002. Atlas presnovodnykh ryb rossii [Atlas of Russian Freshwater Fishes]. Nauka, Moscow. Volume 1:1-379, Volume 2:1-253.

Reshetnikov, Yu. S., Bogutskaya, N. G., Vasil'eva, E. D., Dorofeeva, E. A., Naseka, A. M., Popova, O. A., Savvaitova, K. A., Sideleva, V. G. and Sokolov, L. I. 1997. An annotated check-list of the freshwater fishes of Russia. Journal of Ichthyology, 37(9):687-736.

Reshetnikov, Yu. S. and Shakirova, F. M. 1993. Zoogeograficheskii analiz ikhtiofauny srednei Asii po spiskam presnovodnykh ryb [Zoogeographical analysis of the ichthyofauna of Central Asia by lists of freshwater fish]. Voprosy Ikhtiologii, 33(1):37-45.

Reyahi Khoram, M. and Nafea, M. 2011. Survey on Gamasyab River water quality in Nahavand Township, Iran. Journal of Agricultural Science and Technology, 5(4):495-501.

Reyahi-Khoram, M. and Hoshmand, K. 2012. Assessment of biodiversities and spatial structure of Zarivar Wetland in Kurdistan Province, Iran. Biodiversitas, 13(3):130-134.

Reyahi-Khoram, M., Norisharikabad, V. and Vafaei, H. 2012. Study of biodiversity and limiting factors of Ag-gol Wetland in Hamadan Province, Iran. Biodiversitas, 13(3):135-139.

Reyahi-Khoram, M., Rizvandy, M. and Reyahi-Khoram, R. 2014. The threats on the biodiversity of Bisotun Wildlife Refuge and Bisotun Protected Area (BPA & BWR) in the west region of Iran. Biodiversitas, 15(1):67-74.

Reyhani, P., Ansari, M. R. and Saeb, K. 2013. Assessment of heavy metals contamination in surface water of the upstream Sardabrud River, North of Iran. Life Science Journal, 10(7s):884-892.

Reyhani, S., Rezvani Gilkolaee, S., Mostafavi, P. G., Fazli, H., Porkazemi, M. and Golestani N. 2010. Microsatellite markers indicate a different structure among three populations of the Caspian roach, *Rutilus rutilus caspicus* (Jakowlew, 1870), in the Caspian Sea. Zoology in the Middle East 50(1):67-73.

Reyhani Poul, S. and Jafarpour, A. 2017. Effects of degree of hydrolysis on functional properties and antioxidants activity of hydrolysate from head and frame of common carp (*Cyprinus carpio*) fish. Iranian Journal of Food Science and Technology, 14(68):113-124. In Farsi.

Reza Mojtabavi, H. 1996. Sustainable development and fisheries management in Islamic Republic of Iran. In: Second World Fisheries Conference, Brisbane, Australia, 28 July-2 August 1996 (abstract).

Rezaei, E., Vatandoust, S. and Kazemian, M. 2012. Morphological variability of the *Aspius aspius taeniatus* (Eichwald, 1831) in the southern Caspian Sea basin. Iranian Journal of Fisheries Sciences, 11(3):627-643.

Rezaei, F., Jamili, S., Ehteshami, F., Mashinchian Moradi, A. and Shahidian Namghi, M. 2014. Red blood cells of fish *Cyprinus carpio*. Journal of Animal Environment, 6(3):197-202. In Farsi.

Rezaei, F., Sadeghi, A., Ghader Zadeh, H. and Van Damme, P. 2013. Water quality in the Qheshlagh reservoir (Iran) and downstream the dam. Environmental Engineering and Management Journal, 12(12):2267-2272.

Rezaei, F., Zadeh, H. G. and Van Damme, P. 2012. Determination of the trophic situation in Gheshlagh reservoir (North-Western Iran). Environmental Technology, 33(4-6):523-530.

Rezaei, K., Hedayatifard, M. and Fattahi, E. 2014. Identification and extraction of polycyclic aromatic hydrocarbons (PAHs) from smoked fish and their effects on the quality, microbial, and fatty acid indexes (*sic*). Journal of Mazandaran University of Medical Sciences, 23(108):109-121. In Farsi.

Rezaei, M. 1996. Research on feeding of grass carp (Ctenopharyngodon idella) with emphasis on chemical composition of plants. M.Sc. Thesis of Fishery Department, College of Marine Science, Tarbiat-e Modares University, Tehran. 94 pp. In Farsi.

Rezaei, M. 2009. Genetic diversity study *Rutilus frisii kutum* fish using microsatellite markers. M.Sc. Thesis, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran. In Farsi.

Rezaei, M. and Ahmadi. M. R. 2000. Comparison of food value of different plants in grass carp (Ctenopharyngodon idella) culture. The First Iranian Congress of Fish Health and Diseases, Ahvaz, Iran (abstract). In Farsi.

Rezaei, M., Javadian Seyed, R. E. and Sahari, M. A. 2007. Sensory evaluation and lipid quality of grass carp (*Ctenopharyngodon idella*) stored in ice. Iranian Journal of Natural Resources, 60(2):545-553. In Farsi.

Rezaei, M., Masinchian Moradi, A., Mortazavi, P. and Jamili, Sh. 2020. Effect of chronic exposure to carbamazepine on hematological parameters in *Cyprinus carpio*. Iranian Journal of Fisheries Sciences, 19(1):443-456.

Rezaei, M., Nikfetrat, E. and Khaleghi, R. 1993a. Role of aeration in intensive carp culture. B.Sc. Thesis of College of Natural Resources, Tehran University, Tehran. 148 pp. In Farsi.

Rezaei, M., Nikfetrat, E. and Khaleghi, R. 1993b. Role of aeration in intensive carp culture. Fishery Organization, Ministry of Jihad-e-Sazendegi, Tehran. 148 pp. In Farsi.

Rezaei, M., Shabani, A., Shabanpour, B. and Kashiri, H. 2010a. Genetic comparison of Caspian Sea *Rutilus frisii kutum* (Kamenskii, 1901) in Gorganroud and Chesmekile (Tonekabon) rivers using microsatellite markers. Journal of Taxonomy and Biosystematics, 2(1)(2):1-14.

Rezaei, M., Shabani, A., Shabanpour, B. and Kashiri, H. 2010b. Study of genetic structure of

Rutilus frisii kutum in Golestan Province coastal waters using microsatellite markers. Iranian Scientific Fisheries Journal, 19(3):151-156. In Farsi.

Rezaei, M., Shabani, A., Shabanpour, B. and Kashiri, H. 2011. Microsatellites reveal weak genetic differentiation between *Rutilus frisii kutum* (Kamenskii, 1901) populations south of the Caspian Sea. Animal Biology, 61(4):469-483.

Rezaei, M., Shabani, A., Shabanpour, B. and Kashiri, H. 2013. Microsatellite diversity and population genetic structure of *Rutilus frisii kutum* in Mazandaran coasts. Iranian Journal of Biology, 25(4):548-558. In Farsi.

Rezaei, M. and Papahn, F. 2013. A study of the fish fauna in Hoor-Al Azim wetland. Journal of Applied Ichthyological Research, 1(2):53-60. In Farsi.

Rezaei, M. M., Kamali, A. A., Hasanzadeh Kiabi, B, and Shaabani, A. 2007. A survey of age, growth and reproduction of *Capoeta capoeta gracilis* of the Madarsoo River, Golestan National Park, north-east Iran. Iranian Scientific Fisheries Journal, 16(2):63-74. In Farsi.

Rezaei, M. M., Kamali, A. A., Hasanzadeh Kiabi, B. and Shabani, A. 2007. Impacts of 2001 and 2002 floods and water velocity on frequency of lenkoran, *Capoeta capoeta gracilis*, from the Madarsoo Stream, Golestan National Park, Iran. Journal of Marine Sciences and Technology, 6(1-2):47-56. In Farsi.

Rezaei, M. M., Kamali, A. A., Kiabi, B. and Rahman, H. 2008. Distribution, diversity and abundance of fish species in the Madarsoo River, Golestan National Park, Iran. Iranian Scientific Fisheries Journal, 17(3):65-76. In Farsi.

Rezaei Tavabe, K. and Azarnivand, H. 2013. Biodiversity in qanats (the case study of Kerman County, Iran). Desert, 18(2):99-104.

Rezaei Tavabe, K., Malekian, A., Afzali, A. and Taya, A. 2017. Biological index and pollution assessment of Damghanroud river in the Semnan province. Desert, 22(1):69-75.

Rezaei Tavabe, K., Rafiee, Gh., Moteshafi, F. and Taya, A. 2018. Investigation on effects of common carp (*Cyprinus carpio*) and the silver carp (*Hypophthalmichthys molitrix*) presence in qualitative indices of the wastewater (Case study: Semnan wastewater treatment plant). Journal of Aquaculture Sciences, 6(2):1-12. In Farsi.

Rezaei Tavabe, K., Yavar, M., Kabir, S., Akbary, P. and Aminikhoei, Z. 2020. Toxicity effects of multi-walled carbon nanotubes (MWCNTs) nanomaterial on the common carp (*Cyprinus carpio* L. 1758) in laboratory conditions. Comparative Biochemistry and Physiology, C, Toxicology and Pharmacology, 237:108832.

Rezaei Tavabai, K., Zare Chahouki, M. A., Yazdanpanah, A. and Vazirzadeh, A. 2009. Limnological and pollution study of Shahdadroud River, Kerman Province. Biaban, (Desert) Tehran, 14(1):21-26. In Farsi.

Rezaeitabar, S., Esmaeili Sari, A., Bahramifar, N. and Ramzanpour, Z. 2017. Assessment of water quality of fish pond in the north of Iran (case study: Rasht city). Journal of Breeding and Aquaculture Science, 4(13):23-44. In Farsi.

Rezaie, A., Mousavi, S. M. and Bagherzadeh Ansari, M. 2016. Rhabdomyosarcoma in a silver carp. Journal of Aquatic Animal Health, 28(2):118-121.

Rezaie, A., Tulaby Dezfuly, Z., Mesbah, M. and Ranjbar, A. 2017. Histopathologic report of infestation by *Centrocestus formosanus* in Iranian grass carp and common carp. Iranian Journal of Veterinary Science and Technology, 9(1):49-53.

Rezaie, A., Tulaby Dezfuly, Z. and Peyghan, R. 2017. Fibrosarcoma in a goldfish (*Carassius auratus*): a case report. Iranian Journal of Veterinary Science and Technology, 9(1):45-48.

Rezaiean, H., Hosseini, S., Anousheh, N. and Farjami, B. 2015. Effect of green tea extract on chemical and microbial quality of surimi prepared from silver carp (*Hypophthalmichthys molitrix*). Journal of Utilization and Cultivation of Aquatics, 4(1):109-119. In Farsi.

Rezaii, P. and Zamani Rad, M. 2014. Functional assessment of Minab river water quality in Hormozgan province. Applied Mathematics in Engineering, Management and Technology, 2(6):204-210.

Rezaitabar, S., Esmaili Sari, A., Bahramifar, N. and Ramezanpour, Z. 2017. Transfer, tissue distribution and bioaccumulation of microcystin LR in the phytoplanktivorous and carnivorous fish in Anzali wetland, with potential health risks to humans. Science of the Total Environment, 575:1130-1138.

Rezamand, A. 2017. Investigation of reproductive index of *Hemiculter leucisculus* (Basilewsky, 1855) in Gorganrood River. Journal of Utilization and Cultivation of Aquatics, 6(2):59-67. In Farsi.

Rezamand, A. and Patimar, R. 2018. Evaluation of some growth parameters of *Hemiculter leucisculus* (Basilewsky, 1855) in Gorganrood River. Journal of Utilization and Cultivation of Aquatics, 6(4):55-63. In Farsi.

Rezamand, A., Patimar, R., Ghojoghi, A. and Rahmati, M. 2016. Check variability in length-weight relationship in larvae and juvenile *Rutilus kutum* (Kamenskii, 1901), ponds of bony fish culture of Sijaval - southeastern Caspian Sea. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Rezamand, A., Patimar, R., Jafaraian, H. and Bahalkeh, A. 2016. Length-weight and length-length relationships of *Alburnoides nicolausi* in Huzian River, Lorestan province. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Rezamand, A., Pouladi, M., Qadermarzi, A., Ghorbani, R. and Mohammadi Movahed, M. 2018. Length-weigh relationships of two endemic species of *Alburnoides nicolausi* (Bogutskaya & Coad, 2009) and *Alburnus zagrosensis* (Coad, 2009) in Houzian River, Lorestan Province, Iran. Journal of Applied Ichthyology, 34(3):758-759.

Rezavi, S. *et al*. 1997. Breeding and rearing of the Black Sea roach in the Islamic Republic of Iran. The First Congress of Ichthyologists of Russia, Book of Abstracts, VNIRO Press, Moscow, p. 452.

Rezvani, S., Eimanifar, A., Aghili, R. and Laloei, F. 2006. PCR-RFLP analysis of mitochondrial DNA for identification of *Rutilus rutilus caspicus* populations on the southern coast of the Caspian Sea, Iran. Journal of the Marine Biological Association, U.K., 86(6):1463-1467.

Rezvani Z., Aghlmandi, F., Salarvand, G. H. and Rezaii, A. 2017. Pollution of the Caspian Sea *Rutilus frisi kutum* to monogen (*sic*) parasite *Octomacrum europaeum*. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Rezvani Gilkolaei, S. 2007. Aquaculture development in Sistan-Baluchistan. Visit of fish rearing sector report Zabol-Zahedan 18th to 20th September 2007. Project financed by Italian Cooperation, Italian Ministry of Foreign Affairs. 17 pp.

Rezvani Gilkolaei, S. 2011. Population genetic structure of 2 species from Caspian Sea (*Rutilus frisii kutum* and *Rutilus rutilus*) and 2 species from Persian Gulf and Oman Sea (*Rachycentron canadum* and *Eleutheronema tetradactylum*) using molecular marker. Iranian Fisheries Science Research Institute, Tehran. 306 pp. In Farsi.

Rezvani Gilkolaei, S. 2016. Establishment of gene bank of inland water fish species. Iranian Fisheries Science Research Institute, Tehran. 74 pp. In Farsi.

Rezvani Gilkolaei, S., Hossinzadeh, H. and Azhdehakoshpor, A. 2012. National plan for studying on how can develop aquaculture in Sistan and Baluchistan by carried out research projects such as: Twice a year cultured of shrimp, propagation and breeding of Hamoon fish (*Schizothorax zarudnyi*) and propagation and breeding of three Indian carp species. Iranian Fisheries Science Research Institute, Tehran. 63 pp. In Farsi.

Rezvani Gilkolaei, S., Javanshir, A., Roushan Tabari, M., Roohi, A. and Negarestan, H. 2005. Ecologic comprehensive studies of invasive comb jelly (*Mnemiopsis leidyi*), possibility of biologic control through introducing *Beroe ovata* and mesocosm experiment. Borok II, International Workshop, Invasions of Alien Species in Holarctic, 27 September-1 October 2005, Borok (abstract).

Rezvani Gilkolaei, S., Kavan, S. L. and Safari, R. 2012. A study of genetic structure of *Rutilus frisii kutum* in Anzali Lagoon, using microsatellite markers. Journal of Agricultural Science and Technology, 14(2):327-337.

Rezvani Gilkolaei, S., Lalouei, F., Aghili, R. and Ebrahimzadeh Mousavi, H. A. 2007. Introducing genetic markers to identify and distinguish five species of Cyprinidae in the Caspian Sea using PCR-RFLP. Iranian Scientific Fisheries Journal, 15(5):49-58. In Farsi.

Riahi, A. and Yazdani, S. 2018. Technical efficiency of bony fishes cooperatives in Mazandaran Province: application of data development analysis. Journal of Agricultural Economics Research, 10(2):49-63. In Farsi.

Riahi, M. 1996. Tar, the silent lake. Shekar-o Tabiat, Tehran, (42):52-53. In Farsi.

Riahi Bakhtiari, A. 2001. Determination of the budget and changes of lead and cadmium in the tissues of different fish species in Haraze River (N. Iran). Journal of Environmental Studies, 27(Special Issue):15-22. In Farsi.

Riahi Bakhtiyari, A. 2001. Determination of the level and changes of lead and cadmium in the tissues of different fish species in Harraze River (Amol - Sorkhrood). Daneshvar Medical, 8(31):12-134.

Riahi Bakhtiyari, A. 2002. Concentrations and fluctuations of lead and cadmium in the tissues of different fish species of the Haraz River. Iranian Journal of Marine Sciences, 1(1):37-45, 83. In Farsi.

Riazi, B. 1993. Bahoo-Kalat River basin. Department of the Environment, Tehran. 88 pp. In Farsi.

Riazi, B. 1996. Siah-Keshim. The Protected Area of Anzali Wetland. Department of the Environment, Tehran. 101 pp. In Farsi.

Riazi, B. 2001. Ecosystem structure of Gomishan Wetland. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 224 pp. In Farsi.

Rich, V. 1982. Soviet ecology: Caspian water level drops. Nature, London, 299(5882):384.

Rich, V. 1983. Caspian gulf: whose finger in the dyke? Nature, London, 302(5904):98.

Rich, V. 1991. Floods threaten cities around the Caspian Sea. New Scientist, 130(1773):16.

Richardson, C. J. 2018. Mesopotamian Marshes of Iraq, pp. 1685-1695. In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Ricker, W. E. 1970. Some Fishery Research Stations in the USSR, 1969. Fisheries Research Board of Canada Manuscript Report Series, 1091:109 pp.

Ricker, W. E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations.

Bulletin of the Fisheries Research Board of Canada, 191:xviii + 382 pp.
Ride, W. D. L., Sabrosky, C. W., Bernardi, G. and Melville, R. V. (Eds.). 1985. International Code of Zoological Nomenclature. Third Edition. International Trust for Zoological Nomenclature, London. xx + 338 pp.
Rieben, E. 1954. Report to the Government of Iran on the ground water resources of the Teheran alluvial plain. Food and Agriculture Organization, Rome, Report No. 168(a):24 pp. (English version of FAO Report No. 168 (1953) "Les Ressources en Eaux Souterraines de la Plaine Alluviale de Teheran").
Rigi, M. and Pakzad, S. 2015. Survey of heavy metals (Pb, Ni, Cu, Fe and Zn) accumulation in snow trout (*Schizothorax zarudnyi*). Journal of Animal Environment, 7(1):157-162. In Farsi.
Rives, J. H. 1968. Letter on qanats. Scientific American, 219(3):8, 10, 16.
Robalo, J. I., Almada, V. C., Levy, A. and Doadrio, I. 2007. Re-examination and phylogeny of the genus *Chondrostoma* based on mitochondrial and nuclear data and the definition of 5 new genera. Molecular Phylogenetics and Evolution, 42(2):362-372.
Roberts, N. and Wright, H. E. 1993. Vegetational, lake-level, and climatic history of the Near East and Southwest Asia, pp. 194-220. In: Wright, H. E., Kutzbach, J. E., Webb, T., Ruddiman, W. F., Street-Perrott, F. A. and Bartlein, P. J. (Eds.). Global Climates since the Last Glacial Maximum. University of Minnesota Press, Minneapolis. viii + 569 pp.
Roberts, T. R. and Khaironizam, M. Z. 2008. Trophic polymorphism in the Malaysian fish *Neolissochilus soroides* and other Old World barbs (Teleostei, Cyprinidae). Natural History Bulletin of the Siam Society, 56(1):25-53.
Robins, C. R., Bailey, R. M., Bond, C. E., Brooker, J. R., Lachner, E. A., Lea, R. N. and Scott, W. B. 1991. World Fishes Important to North Americans Exclusive of Species from the Continental Waters of the United States and Canada. American Fisheries Society Special Publication, 21:viii + 243 pp.
Rodionov, S. N. 1994. Global and regional climate interaction: the Caspian Sea experience. Kluwer Academic Publishers, Dordrecht/Boston/London. vii + 241 pp.
Rodler, A. 1887. Der Urmia-See und das nordwestliche Persien. Vereine zur Verbreitung naturwissenschaftlicher Kenntnis in Wien, 27:535-575.
Rögl, F. 1998. Palaeogeographic considerations for Mediterranean and Paratethys seaways (Oligocene to Miocene). Annalen des naturhistorischen Museums in Wien, 90A:279-310.
Rögl, F. 1999. Oligocene and Miocene palaeogeography and stratigraphy of the circum-Mediterranean region, pp. 475-500. In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.
Rögl, F. and Steininger, F. F. 1984. Neogene Paratethys, Mediterranean and Indo-pacific seaways. Implications for the paleobiogeography of marine and terrestrial biotas, pp. 171-200. In: Brenchley, P. J. (Ed.). Fossils and Climate. John Wiley & Sons, New York. xv + 352 pp.
Rohani, N. 2004. Kavir park, a forgotten region!! Sharq (Persian Morning Daily), 135:3 pp. (www.netiran.com/Htdocs/WeeklyJournal/Social/wj01733.html, downloaded 2 March 2004).
Rohbakhshan, A. 1991. Aquatic organisms in the old Persian literature: Naser Khosro and a seven year journey around the civilised world 1000 years ago. Abzeeyan, Tehran, 7:24-

25. In Farsi.
Rohei Aminjan, A. and Malek, M. 2004. Ecology of helminthes parasites of *Capoeta capoeta gracilis* from Shiroud River, Iran. Iranian Scientific Fisheries Journal, 13(2):73-82. In Farsi.
Rohollah Javadian, S. 2010. Effect of thawing methods on the chemical, biochemical, microbiological and sensory indices of Caspian Sea kutum (Rutilus frisii kutum) and rainbow trout (*Oncorhynchus mykiss*). Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 68 pp. In Farsi.
Rokhnareh, Z., Ahamdniaye Motlagh, H., Safari, O. and Selahvarzi, Y. 2019. Changes in gut bacteria and yeast count of *Carassius auratus* fed pomegranate (*Punica granatum*) peel extract supplemented diets. The 7th Iranian Conference of Ichthyology, Lorestan University, 30-31 October 2019 (abstract).
Romanov, N. S. 1955. Annotated Bibliography on Fisheries of the Southern Basins of the U.S.S.R. (1918-1953). Israel Program for Scientific Translations, Jerusalem (1968). 400 pp.
Romero, A. 2008. Typological thinking strikes again. Review of “Proudlove, G. S. 2006. Subterranean fishes of the world. International Society for Subterranean Biology, Moulis. 287 pp. US$65.” Environmental Biology of Fishes, 81(3):359-363.
Romero, A. and Green, S. M. 2005. The end of regressive evolution: examining and interpreting the evidence from cave fishes. Journal of Fish Biology, 67(1):3-32.
Romero, A. and Paulson, K. M. 2001. It’s a wonderful hypogean life: a guide to the troglomorphic fishes of the world. Environmental Biology of Fishes, 62(1-3):13-41.
Roohi, Z., Imanpoor, M. R., Jafari, V. and Taghizadeh, V. 2015. The use of fenugreek seed meal in fish diets: growth performance, haematological and biochemical parameters, survival and stress resistance of common carp (*Cyprinus carpio* L.). Aquaculture Research, 48(3):1209-1215.
Roohi, Z., Imanpoor, M. R., Jafari, V. and Taghizadeh, V. 2017. The effect of salinity stress on survival, biochemical and blood parameters in fingerling *Cyprinus carpio* fed with herbal supplement of *Carum carvi*. Nova Biologica Reperta, 4(1):47-54. In Farsi.
Roohi, A., Kideys, A. and Fazli, H. 2003. Comparative study on lipid quality of distribution and abundance of *Mnemiopsis leidyi* on the eastern Iranian coasts of the Caspian Sea. Iranian Scientific Fisheries Journal, 12(3):67-82. In Farsi.
Roohi, A., Kideys, A. E., Sajjadi, A., Hashemian, A., Pourgholam, R., Fazli, H., Ganjian Khanari, A. and Eker-Develi, E. 2010. Changes in biodiversity of phytoplankton, zooplankton, fishes and macrobenthos in the southern Caspian Sea after the invasion of the ctenophore *Mnemiopsis leidyi*. Biological Invasions, 12(7):2343-2361.
Roohi, A., Naderi Jolodar, N., Nasrollazadeh, H., Fazli, H., Afraei Bandpaei, M. A., Rowshantabari, M., Makhlogh, A., Sadat Tahami, F., Khodaparast, N., Mirzaei, R. and Hossienpour, H. 2018. Natural production assessment of Azad Sanandaj reservoir to produce fish. Journal of Aquaculture Development, 12(4):24-49. In Farsi.
Roohi, Z., Imanpoor, M. R., Jafari, V and Taghizadeh, V. 2015. Effect of caraway (*Carum carvi*) on growth factors and some blood parameters in common carp (*Cyprinus carpio*). Journal of Animal Environment, 7(1):105-112. In Farsi.
Roomiani, L., Ghaeni, M., Moarref, M., Fallahi, R. and Lakzaie, F. 2019. The effect of *Rosmarinus officinalis* essential oil on the quality changes and fatty acids of *Ctenopharyngodon idella*. Iranian Journal of Fisheries Sciences, 18(1):95-109.

Roonwal, M. L. 1956. The late Dr. Sunder Lal Hora (1896-1955): an appreciation together with a complete list of his scientific writings. Records of the Indian Museum, 54(3-4):107-137.

Rooshan Tabari, M. 1996. Tajan River and its ecological situation. Abzeeyan, Tehran, 7(2):16-20, II-III. In Farsi.

Roosta, Z., Falahatkar, B., Sajjadi, M. M., Paknejad, H. and Kestemont, P. 2020. A comparative study on some biochemical and enzymatic parameters of plasma and mucus during reproductive stages in female goldfish (*Carassius auratus*). Journal of Animal Research (Iranian Journal of Biology), 33(2):160-171. In Farsi.

Roosta, Z., Hajimoradloo, A. and Ghorbani, R. 2015. The of minimum inhibitory concentration of growth in the epidermal mucus of Caspian roach (*Rutilus rutilus caspicus*) fed dietary supplemented with different levels of vitamin C by disc diffusion method. Journal of Fisheries, 9(2):47-53. In Farsi.

Roosta, Z., Hajimoradloo, A., Ghorbani, R. and Hoseinifar, Sh. 2014. The effects of dietary vitamin C on mucosal immune responses and growth performance in Caspian roach (*Rutilus rutilus caspicus*) fry. Fish Physiology and Biochemistry, 40(5):1601-1607.

Roselaar, C. S. (Kees) and Aliabadian, M. 2007. A century of breeding bird assessment by western travellers in Iran, 1876-1977. Podoces, 2(2):77-96, appendix.

Roshan, M. D. and Moini, S. 2009. The effect of washing of water soluble protein on the quality of the surimi produced from silver carp (*Hypophthalmichthys molitrix*). The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 133 (abstract).

Roshan Tabari, M. 1995. Hydrology and hidrobiology (*sic*) of Tadjan River. Iranian Fisheries Scientific Journal, 3(4):59-72, 7. In Farsi.

Roshan Tabari, M. 1997. Hydrological and hydrobiological study in the Siyah-rud River. Iranian Fisheries Scientific Journal, 6(2):27-42, 6. In Farsi.

Roshan Tabari, M., Rahmati, R., Vahedi, F., Khodaparast, N. and Roohani Ardeshiri, R. 2011. The influences of sand and gravel exploitation in Tajan River substrate on abundance and species composition of fish. Journal of Fisheries, 5(4):95-102. In Farsi.

Roshan Tabari, M., Takmeliyan, K., Najafpoor, Sh., Abdoli, A. and Fourooghi-e Fard, H. 2001. Hydrology and hydrobiology of Chaloos River. Iranian Scientific Fisheries Journal, 9(4):1-14. In Farsi.

Ross, E. C. 1883. Notes on the River Mand or Kara-Aghatch (the Sitakos of the Ancients) in southern Persia. Journal of the Royal Geographical Society, 5(12):712-716.

Rostami, I. 1940. Normes de consommation des matériaux dans la Société des pêcheries du nord de l'Iran, sous la direction de I. Rostami. Bandar Pahlavi, Iran. MS. In Farsi and Russian.

Rostami, I. 1943. Determination of the quality of products from fish. Bulletin of the Veterinary Faculty, University of Tehran, 1943 (January-March):476-612. In Farsi.

Rostami, I. 1945. Freshwaters of the Caspian basin (in Iran) and the conservation of fish stocks. Bulletin of the Veterinary Faculty, University of Tehran, 1945 (August-November):111-175. In Farsi.

Rostami, I. 1946. Ichthyofauna of Iran and its utilization. Bulletin of the Veterinary Faculty, University of Tehran, 1946 (October-March):89-113. In Farsi.

Rostami, I. 1950. Utility of the expansion of the fishery for certain fishes on the northern coast of Iran. Reviews of the Veterinary Faculty, University of Tehran, 1:68-98. In Farsi.

Rostami, I. 1961. Acclimation and raising fish in Karadj Reservoir. Studies of the Karadj Water and Power Organization. MS.

Rostami, I. 1963. Acclimatization of some species of fish in the Karadj River Basin. Gohar

Printing, Tehran. 22 pp.
Rostami, M., (with Eagderi, S., Imani Harsini, J. and Poorbagher, H. - *sic*). 2018. Study of the relationship between morphology and genetic variation in the genus *Alburnoides* (Pisces: Cyprinidae) in Iran using geometric morphometric methods and cytochrome oxidase 1 (COI) sequences. M.Sc. Thesis, Department of Fisheries, Faculty of Natural Resources, University of Tehran. 74 pp. In Farsi.
Rostami, M. and Soltani, M. 2009. Histopathological effects of copper sulphate chronic doses on common carp (*Cyprinus carpio*). Journal of Veterinary Research, 64(3):193-198. In Farsi.
Rostami, M. R. 2001. Study of the mix factors of marketing effects on the behavioural mechanism of fishery products consumers in Iran. M.Sc. Thesis, Tarbiat Modarres University, Tehran. 188 pp. In Farsi.
Rostami, Y. A. and Askary Sary, A. 2014. Copper hazard quotient (HQ) determination in muscle of four species of carp cultured fish from Khuzestan Province. Breeding and Aquaculture Sciences Quarterly, 2(3):11-24. In Farsi.
Rostami Bashman, M., Soltani, M. and Sasani, F. 2001. A survey of copper (Cu), zinc (Zn), mercury (Hg), cadmium (Cd) histopathological lesions in common carp (*Cyprinus carpio*). Journal of the Faculty of Veterinary Medicine, University of Tehran, 55(4):1-3. In Farsi.
Rostami Beshman, M., Kakoolaki, S., Salamat, N., Salaramoli, G., Razavilar, V. and Aliesfahani, T. 2010. A quantitative analysis of lead, mercury and cadmium intake by two commercial aquatics, *Hypophthalmichthys molitrix* and *Oncorhynchus mykiss*. 9th International Congress on the Biology of Fish, Barcelona, 5-9 July 2010 (abstract).
Rostamian, N., Eagderi, S., Vatandoust, S. and Salar, H. 2017. Habitat use and suitability index of *Capoeta capoeta gracilis*, in the Kalarud River. Journal of Animal Environment, 9(2):141-146. In Farsi.
Rostamian, N., Masoudi, E., Gerami, M. H., Azizpour, S. and Ullah, S. 2015. Spatial and temporal variability of phytoplankton assemblages and physico-chemical characterization in three similar dams. Fisheries and Aquaculture Journal, 6:136 (4 pp.)
Rostamnezhad, M., Khara, H. and Ahmadnezhad, M. 2019. Evaluation of reproductive ability and histological properties in gonads of Persian vimba (*Vimba persa*) immigrant to Anzali Wetland and Sefid River. Journal of Fisheries (Iranian Journal of Natural Resources), 71(4):329-341. In Farsi.
Rostamzad, H., Abbasi Mesrdashti, R., Akbari Nargesi, E. and Fakouri, Z. 2019. Shelf life of refrigerated silver carp, *Hypophthalmichthys molitrix*, fillets treated with chitosan film and coating incorporated with ginger extract. Caspian Journal of Environmental Sciences, 17(2):143-153.
Rostamzadeh, A., Allaf Noverian, H., Sajjadi, M. and Hoseinifar, S. H. 2019. The effects of different levels dietary sodium acetate on growth performance and digestive enzymes activity in goldfish (*Carassius auratus*). Journal of Animal Environment, 11(3):173-180. In Farsi.
Rostandeh, E., Shamsaei, M., Behmanesh, M. and Nikpour, Z. 2014. A survey of bactocell microbial complementary on growth, survival and immunological factors of kutum (*Rutilus frisii kutum*). Breeding and Aquaculture Sciences Quarterly, 2(2):35-48. In Farsi.
Roufchaie, R., Hoseinifar, S. H., Zamini, A., Sayadborani, M., Maghsodi Kohan, H. and Faied, M. 2013. Effects of glucan on growth performance, carcass composition and intestinal microbiota in *Rutilus frisii kutum* fingerling. Journal of Fisheries Science and

Technology, 2(1):43-54. In Farsi.
Rouhani, H. and Sadat Jafarzadeh, M. S. 2018. Assessing the climate change impact on hydrological response in the Gorganrood River Basin, Iran. Journal of Water and Climate Change, 9(3):421-433.
Rouholahi, S., Rezvani Gilkolaei, S., Soltani, M., Mohamadian, S., Ghodratnama, M. and Taheri Mirghaed, A. 2012. Genetic identification and distance between *Chalcalburnus chalcoides* and *Vimba vimba persa* in Southern part of Caspian Sea. XIV European Congress of Ichthyology, Liège, Belgium, 3-8 July 2012 (poster).
Rouholahi, S., Zolgharnein, H., Rezavani Gilkolaei, S., Salari Aliabadi, M. A., Mohamadian, S., Taghavi, M. J., Laluei, F. and Shojaei, H. 2012. Inheritance of microsatellite markers in the hybrid of female *Chalcalburnus chalcoides* and male *Vimba vimba persa Chalcalburnus chalcoides* (Gueldenstaedt, 1772) x *Vimba vimba persa* (Pallas, 1814) (*sic*). Journal of Marine Sciences and Technology, 10(2):50-58. In Farsi
Roushan Tabary, M. 1996. Hydrology and hydrobiology of the Haraz River. Iranian Fisheries Scientific Journal, 5(2):43-63, 5. In Farsi.
Roux, C. 1961a. Quelques aspects de la faune de la Mer Caspienne. Comptes Rendus de la Société de Biogéographie, 38(333):51-53.
Roux, C. 1961b. Rapport sommaire sur une Mission en Iran. Bulletin du Muséum national d'Histoire naturelle, Paris, 2(33):294-295.
Rowe, G. T. 1996. Azerbaijan, oil, and sustainable development in Azerbaijan. Quarterdeck, College Station, Texas, 4(3):10 pp. (internet version).
Rowley, G. 1986. Irrigation systems in the Holy Land: a comment. Transactions of the Institute of British Geographers, new series, 11(3):356-359.
Rowshan Tabari, M. 2007. Physico-chemical parameters and aquatic investigation in Tajan River and identification of effects on its destruction. Iranian Fisheries Science Research Institute, Tehran. 114 pp. In Farsi.
Rowshan Tabari, M., Kiabi, B., Solimaniroudi, A., Vahedi, F., Makhlogh, A. and Rahmati, R. 2015. Environment risk assessment of sand and silt exploitation from Tonekabon River. Journal of Environmental Science and Technology, 16(Special Issue):149-157. In Farsi.
Roy, R. N. 1996. Project formulation for fisheries training and extension. Islamic Republic of Iran. Technical Report, Fisheries Extension Service, FAO Technical Cooperation Programme, Rome. 43 pp.
Rozengurt, M. A. and Hedgpeth, J. W. 1989. The impact of altered river flow on the ecosystem of the Caspian Sea. Reviews in Aquatic Sciences, 1(2):337-362.
Rucevska, I. (Ed.). 2006. Vital Caspian Graphics. Challenges beyond Caviar. UNEP/GRID-Arendal, UNEP and Caspian Environment Programme. 72 pp.
Rudin, Z. N. 1966. K voprosu o sovremennom razvitii rybnogo khozyaistva iranskogo Kaspiya [On the problems concerning contemporary progress in the fisheries economy of the Iranian Caspian]. In: Problemy ekonomiki i istorii stran Blizhnego i Srednego Vostoka. Izdatel'stvo Nauka, Moskva, pp. 139-149.
Rufchaei, R. and Hoseinifar, S. H. 2014. Effects of dietary commercial yeast glucan on innate immune response, hematological parameters, intestinal microbiota and growth performance of white fish (*Rutilus frisii*) fry. Croatian Journal of Fisheries, 72(4):156-163.
Rufchaei, R., Hoseinifar, S. H., Mirzajani, A. and Van Doan, H. 2017. Dietary administration of *Pontogammarus maeoticus* extract affects immune responses, stress resistance, feed

intake and growth performance of Caspian roach (*Rutilus caspicus*) fingerlings. Fish and Shellfish Immunology, 63:196-200.

Rufchaei, R., Hoseinifar, S. H., Nedaei, S., Bagheri, T., Ashouri, G. and Van Doan, H. 2019. Non-specific immune responses, stress resistance and growth performance of Caspian roach (*Rutilus caspicus*) fed diet supplemented with earthworm (*Eisenia foetida*) extract. Aquaculture, 511:734275.

Rufchaie, R., Hoseinifar, S. H., Parvaneh, D. and Purgholami, A. 2017. Enfluence dietary (*sic*) of extract (*Eisenia fetida*) on immune factor in Caspian roach (*Rutilus caspicus*) fry. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Rufchaie, R., Hoseinifar, S. H., Parvaneh Moghadam, D. and Ghorbani, S. 2017. Enfluence dietary (*sic*) of extract (*Eisenia fetida*) on salinity stress resistance in Caspian roach (*Rutilus caspicus*) fry. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Rufchaie, R., Hoseinifar Seyed, H., Mirzajani, A. and Ghorbani, S. 2018. Evaluation of amino acids and fatty acids profiles of Gammaridae extracts and its effects on feed acceptability, utilization, growth performance and salinity stress resistance in Caspian roach (*Rutilus caspicus*, Yakovlev, 1879) fingerlings. Journal of Applied Ichthyological Research, 6(1):91-104. In Farsi.

Rufchaei, R., Nasri Tajen, M., Salavation Seyed, M., Jamili, S., Hematkar, F. and Ghorbani, S. 2020. Evaluation of the effect of different levels of *Pontogammarus maeoticus* extract on growth indices, carcass composition and mucosal safety of *Rutilus kutum*, Kamenskii, 1901. Iranian Scientific Fisheries Journal, 28(6):47-55. In Farsi.

Ruhi, A. 1998. The biomass and species composition of zooplankton populations in Gorgan Bay. Iranian Fisheries Scientific Journal, 6(4):35-46, 4. In Farsi.

Russel, A. 1756. An account of four undescribed fishes of Aleppo; in a letter to Mr. Peter Collinson, F.R.S. by Alexander Russel, M.D. Philosophical Transactions of the Royal Society, London, 49:445-449, 1 pl.

Russell, A. 1794. Chap. III. Of Fishes, pp. 207-219, pls. VI-VII. In: Vol. II. The Natural History of Aleppo, containing a description of the city, and the principal natural productions in its neighbourhood together with an account of the climate, inhabitants and diseases; particularly of the plague. Second Edition by P. Russell. London. Volume I:xxiv + 446 pp., Appendix (xxiii) + Errata (1 page); Volume II:v + 430 pp., + Appendix (xxxiv) + Index to both volumes (25 pp., not numbered) + Errata (1 page).

Rustami, P., Rahmani, H. and Haghparast, S. 2018. The impact of environmental parameters on fish biodiversity of Lavij River, Noor, Mazandaran. Journal of Applied Ichthyological Research, 6(2):13-30. In Farsi.

Ruttner-Kolisko, A. 1964. Kleingewässer am Ostrand der persischen Salzwüste. Ein Beitrag zur Limnologie arider Gebiete. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 15(1):201-208.

Ruttner-Kolisko, A. 1966. The influence of climatic and edaphic factors on small astatic waters in the East Persian salt desert. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 16(1):524-531.

Ruttner, A. W. and Ruttner-Kolisko, A. E. 1972. Some data on the hydrology of the Tabas - Shirgesht - Ozbak-kuh area (East Iran). Jahrbuch der Geologischen Bundesanstalt, Wien, 115:1-48, 2 plates.

Ruttner, A. W. and Ruttner-Kolisko, A. E. 1973. The chemistry of springs in relation to the geology in an arid region of the Middle East (Khurasan, Iran). Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 18(3):1751-1752.

Ryan, P. R. 1986. Soviets shelve plan on diverting rivers in Arctic regions. Oceanus, 29(1):78-80.

Ryan, S. 1994. Saddam kills off marsh wildlife in eco-disaster. Sunday Times, London, No. 8,852, p. 1.16 (17 April 1994).

Rychagov, G. I. 1997. Holocene oscillations of the Caspian Sea, and forecasts based on palaeogeographical reconstructions. Quaternary International, 41/42:1671-172.

Rylková, K., Kalous, L., Bohlen, J., Lamatsch, D. K. and Petrtýl, M. 2013. Phylogeny and biogeographic history of the cyprinid fish genus *Carassius* (Teleostei: Cyprinidae) with focus on natural and anthropogenic arrivals in Europe. Aquaculture, 380-383:13-20.

Rzóska, J. 1980. Euphrates and Tigris, Mesopotamian ecology and destiny. Monographiae Biologicae, 38:x + 122 pp.

S

Saad, M. A. H. 1978a. Some limnological studies on the lower reaches of Tigris and Euphrates, Iraq. Acta Hydrochimica et Hydrobiologica, 6(6):529-539.

Saad, M. A. H. 1978b. Seasonal variations of some physico-chemical conditions of Shatt al-Arab estuary, Iraq. Estuarine and Coastal Marine Science, 6(5):503-513.

Saad, M. A. H. and Antoine, S. E. 1978a. Limnological studies on the River Tigris, Iraq. I. Environmental characteristics. Internationale Revue der Gesamten Hydrobiologie, 63(5):685-704.

Saad, M. A. H. and Antoine, S. E. 1978b. Limnological studies on the River Tigris, Iraq. II. Seasonal variations of nutrients. Internationale Revue der Gesamten Hydrobiologie, 63(5):705-749.

Saad, M. A. H. and Antoine, S. E. 1978c. Limnological studies on the River Tigris, Iraq. III. Phytoplankton. Internationale Revue der Gesamten Hydrobiologie, 63(6):801-814.

Saad, M. A. H. and Antoine, S. E. 1982. Effect of pollution on phytoplankton in Al-Khandak and Al-Rabat, polluted outlet canals of the Shatt al-Arab estuary at Basrah, Iraq. Internationale Revue der Gesamten Hydrobiologie, 67(3):419-429.

Saad, M. A. H. and Antoine, S. E. 1983. Effect of pollution on phytoplankton in the Ashar Canal, a highly polluted canal of the Shatt al-Arab estuary at Basrah, Iraq. Hydrobiologia, 99(3):189-196.

Saad, M. A. H. and Kell, V. 1975. Observations on some environmental conditions as well as phytoplankton blooms in the lower reaches of Tigris and Euphrates. Wissenschaftliche Zeitschrift der Universität Rostock Mathematisch-Naturwissenschaftliche, 24(6):781-787.

Saadatfar, Z., Asadian, M. and Alishahi, E. 2008. Structure of barbel in Cyprinidae (*Cyprinus carpio*). World Applied Sciences Journal, 4(1):100-103.

Saadati, M. 1974. Research proposal for the biological control of aquatic weeds on the Dez Irrigation Project at Andimeshk, Iran. Submitted to Department of the Environment, Parks and Wildlife Division, Khuzestan Water and Power Authority and Colorado State University, Department of Fishery and Wildlife Biology. MS, 9 pp.

Saadati, M. A. G. 1977. Taxonomy and distribution of the freshwater fishes of Iran. M.S. Thesis, Colorado State University, Fort Collins. xiii + 212 pp.

Saatloo, M. E., Saatloo, J. E., Merufinia, E. and Siosemarde, M. 2014. Usage alteration of the Nazlu-Chay River of Iran due to excessive exploit of its material includes sand and gravel in the Lake Urmia catchment. Journal of Civil Engineering and Urbanism, 4(3):251-255.

Sabah, Z. 2006. Conflict doesn't stop Iraqi tradition of fish grilling. USA Today, 9/7/2006, 2 pp. (http://usatoday.com).

Sabaj, M. H. 2020. Codes for Natural History Collections in Ichthyology and Herpetology. Copeia, 108(3):593–669.

Sabaj Pérez, M. H. (Ed.). 2010. Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an Online Reference Version 1.5 (4 Oct 2010). www.asih.org. American Society of Ichthyologists and Herpetologists, Washington, D.C. 35 pp.

Saberi, H., Aliakbar, A. and Ashournia, M. 2011. Determination of unsaturated fatty acids (EPA, DHA) and omega 6 in three species of aquaculture fish, rainbow trout, common carp and silver carp. Iranian Journal of Biology, 24(4):528-538. In Farsi.

Saberi, H. J. 1998. Fish in Afghanistan, pp. 259-263. In: Walker, H. (Ed.). Fish. Food from the Waters. Proceedings of the Oxford Symposium on Food and Cookery 1997. Prospect Books, Totnes, Devon. 335 pp.

Saberifar, S., Shahriari, A. and Peyghan, R. 2020. Effect of subacute intoxication with nitrite on AMP-deaminase activity in skeletal muscles of common carp (*Cyprinus carpio*). Turkish Journal of Fisheries and Aquatic Sciences, 20(8):613-622.

Saberyan Juybari, M., Ghobadi, Sh. and Vatandoust, S. 2017. Effect of different levels of prebiotic A-max on growth performance, survival rate and body composition of common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 11(1):63-75. In Farsi.

Sabkara, J. and Makaremi, M. 2013. The density and distribution of the plankton, and their role in fish culture in Aras Reservoir Dam. Journal of Aquaculture Development, 7(2):41-59. In Farsi.

Sabkara, J., Makaremi, M. and Valipour, A. 2016. Yamchi Dam coastal plankton communities to assess the feasibility of aquaculture in the city of Ardebil. Journal of Aquaculture Development, 10(1):71-89. In Farsi.

Sabri Asi, I., Taghizadeh, V. and Imanpoor, M. R. 2018. Comparison of the injection effects of ovaprim, HCG and *Barbus* fish pituitary extract on spermatological parameters in goldfish (*Carassius auratus gibelio*). Journal of Aquaculture Development, 12(2):63-74. In Farsi.

Sabzalizadeh, S. 2006. Ecological investigation on Dez Dam lake. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Ahvaz. http://en.ifro.ir (abstract).

Sabzalizadeh, S. and Amirineia, S. 2003. Study on some physical and chemical characteristics of Shadegan Marsh. Iranian Scientific Fisheries Journal, 12(2):47-62. In Farsi.

Saç, G. 2020. New localities and length-weight relationship for *Alburnus caeruleus* in the Euphrates and Tigris River basins (Turkey). Aquatic Sciences and Engineering, 35(4):11-15.

Sadat Hosseyni, A., Shabani, A. and Kashiri, H. 2017. Microsatellite diversity of common carp (*Cyprinus carpio*) in Golestan coasts. Journal of Animal Environment, 9(3):253-258. In Farsi.

Sadat Naeemi, A. 2012. Determination of bioaccumulation and microscopic survey of LAS pollutant effect on the liver, kidney and gill tissues of *Rutilus frisii kutum* in Caspian Sea. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 164 pp. In Farsi.

Sadeghi, A. and Imanpour, M. R. 2016. Effect of several extenders and different concentrations of cryoprotectants (methanol and glycerol) on quality of goldfish (*Carassius auratus*) post-thawed sperm. Journal of Utilization and Cultivation of Aquatics, 5(1):1-11. In Farsi.

Sadeghi, A., Imanpour, M. R., Shabani, A., Mazandarani, M. and Bagheri, T. 2018a. Effect of dietary lipid levels on some growth indices and survival rate of gold fish (*Carassius auratus*). Journal of Animal Environment, 10(1):231-236. In Farsi.

Sadeghi, A., Imanpour, M. R., Shabani, A., Mazandarani, M. and Bagheri, T. 2018b. Study of the protective effects of livergol drug on the liver histology of goldfish (*Carassius auratus*). Journal of Animal Environment, 10(4):389-394. In Farsi.

Sadeghi, A., Pourmozaffar, S. and Gozari, M. 2020. Effect of livergol on growth indices and gonadal development in different levels of dietary lipid in goldfish (*Carassius auratus*). Journal of Animal Environment, 12(1):323-330. In Farsi.

Sadeghi, H. and Agheli, L. A. 2002. Evaluation of fish resources depreciation in Iran. Pajouhesh va Sazandegi, 15(2)(55):11-15. In Farsi.

Sadeghi, H., Shajiee, H. and Sharafi, S. 2013. Identification and study of distribution of qanat fish species in Shahroud area. Journal of Animal Biology, 5(2):63-77. In Farsi.

Sadeghi, M. 1995. Heavy metal concentrations in edible fishes from Anzali Wetland. Iranian Fisheries Research and Training Press, Tehran. 57 pp. In Farsi.

Sadeghi, M., Emtiazju, M. and Shahbazi, A. 2018. Determination of heavy metals (Co, Cr) in muscle, skin and gill tissues of *Chalcalburnus chalcoides* in south of Caspian Sea (Anzali lagoon and Shirud). Journal of Animal Environment, 10(3):289-296. In Farsi.

Sadeghi Dehsahraii, H., Shadkhast, M. and Nematollahy, A. 2013. Erythrocyte size and morphological characterization of the leukocyte in circulating blood of *Hypothalamiichtys*(*sic*) *molitrix* (Silver Carp) in Iran. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 60 (abstract).

Sadeghi Limanjoob, R., Farzam, M., Jamali, H., Syahmard, N., Kargar Jahromi, H. and Farzam, M. 2014. Infection rate of common carp (*Cyprinus carpio*) to *Lernaea cyprinacea* parasite in warm season of year in farming ponds of Shushtar Region in Khuzestan Province. Biomedical and Pharmacology Journal, 7(1):333-339.

Sadeghi Limanjoob, R., Kargar Jahromi, H., Daneshi Seyed, A., Syahmard, N., Bathaee Seyed, H., Mahmoudi Teimourabad, S. and Farzam, M. 2014. Fish silver carp, and rejoin heat pathology review Amur fish parasite skin hookworm (liern A,) in Ahvaz (*sic*). Advances in Environmental Biology, 8(2):505-509.

Sadeghi Limanjoob, R., Kargar Jahromi, H., Heydari, Y., Syahmard, M., Bathaee, S. H., Mahmoudi Teimourabad, S. and Farzam, M. 2014a. Investigating the prevalence of ligulae among carp fish in Parishan Lake. Advances in Environmental Biology, 8(2):502-504.

Sadeghi Limanjoob, R., Kargar Jahromi, H., Heydari, Y., Syahmard, M., Bathaee, S. H., Mahmoudi Teimourabad, S. and Farzam, M. 2014b. Investigating the prevalence of boteriosophalosise among the carp fish in Parishan Lake. Advances in Environmental Biology, 8(2):515-517.

Sadeghi Limanjoob, R., Kargar Jahromi, H., Shafiei Jahromi, N., Syahmard, M., Bathaee, S. H., Mahmoudi Teimourabad, S. and Farzam, M. 2014. Histopathological studies on the prevalence of gill necrosis in carp carrot Lake distracted Kazeroon (*sic*). Advances in Environmental Biology, 8(2):510-514.

Sadeghi Limanjoob, R., Pourdavood, M., Kargar Jahromi, H., Syahmard, N., Bathaee, S. H., Mahmoudi Teimourabad, S. and Farzam, M. 2014. Identification and investigation of morphological characteristics (weight and length) of fishes in Fahliyan River. Unique Journal of Pharmaceutical and Biological Sciences, 2(2):21-25.

Sadeghi Rad, M. 1997. Heavy metal determination in fish species of Anzali Lagoon. Iranian Fisheries Scientific Journal, 5(4):1-16, 1. In Farsi.

Sadeghi Zadegan, S. 2018a. Bujagh National Park (Islamic Republic of Iran), pp. 1625-1633. In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Sadeghi Zadegan, S. 2018b. Fereydoon Kenar, Ezbaran & Sorkh Ruds Ab-Bandans, pp. 1635-1646. In: Finlayson, C. M., Milton, G. R., Prentice, R. C. and Davidson, N. C. (Eds.). The Wetland Book. Springer, Dordrecht. 2142 pp.

Sadeghinejad, M. E. 2001. The identification of native fishes in Lorestan Province. Lorestan Research Centre for Natural Resources and Animal Sciences. 83 pp. In Farsi.

Sadeghinejad, M. E. and Abbasi, K. 2021. Effect of sediment ponds on fish diversity in Anzali Wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Sadeghinejad Masouleh, E. 2013. Several fish species carp culture with Chinese black carp to increase diversity in warm water fish farms. Iranian Fisheries Science Research Institute, Tehran. 111 pp. In Farsi.

Sadeghinejad Masouleh, E. 2018. The survey on aquaculture capacity of Ghar-Khatlo dam reservoir in Zanjan province. Iranian Fisheries Science Research Institute, Tehran. 70 pp. In Farsi.

Sadeghinejad Masouleh, E. 2021. Investigation of distribution and frequency of *Carassius gibelio* fish in Anzali wetland. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 8 pp. In Farsi.

Sadeghinejad Masouleh, E. and Abbasi, K. 2018a. Survey of the frequency and population structure of *Cyprinion macrostomum* in Simare River (Lorestan Province). Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Sadeghinejad Masouleh, E. and Abbasi, K. 2018b. Surveying of the frequency and population structure of *Capoeta trutta* in the Simare River (Lorestan Province). Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Sadeghinejad Masouleh, E. and Darvishian, R. 2017. The survey of frequency and distribution of *Cyprinion macrostomum* in the Kashkan River - Lorestan. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 195-202. In Farsi.

Sadeghinejad Masouleh, E. and Radkhah, A. R. 2018. Length-weight relationship of white fish (*Squalius berak*) in the Kashkan River of Lorestan Province. Conference on Conservation

of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Sadeghinejad Masouleh, E., Sayad Bourani, M., Shrifiyan, M., Hosenjani, A. and Ahamdnezhad, M. 2018. Multi-species culture of black carp (*Mylopharyngodon piceus*) with Chinese carps in Iran. Journal of Aquaculture Development, 12(2):75-87. In Farsi.

Sadeghinejade Masouleh, E. 2008. Ecological studies of Bisheh-Dalan Wetland (Borojerd). Iranian Fisheries Science Research Institute, Tehran. 75 pp. In Farsi.

Sadegi, M. M. 2003. Creating Karkheh. International Water Power & Dam Construction, 55(1):36-37.

Sadeq, G. N. 1999. Hamoun with its latent beauty and migrating birds on the verge of destruction. Osveh (Cultural, Political and Social Magazine of Sistan and Baluchestan Province), 1999(7):15 pp. (www.netiran.com/Htdocs/Clippings/Social/991121XXSO01.html, downloaded 3 May 2000).

Sadlayev, K., Novikov, N. and Zanov, S. 1965. Economic and Technical Report of the Production of Fish Stocks in Iranian Waters of the Caspian Sea. Fisheries Research Centre of Guilan Province, Bandar Anzali. 142 pp. In Farsi.

Saeedi, A. A., Adel, M. and Safari, R. 2013. Comparison of biometrics, hematological and reproductive indices in female breeders *Rutilus frisii kutum* in Shirood and Tajan rivers during 2006-2008. Journal of Aquatic Animals and Fisheries, 4(14):27-34. In Farsi.

Saeedi, A. A., Khoshbavar Rostami, H. A., Adel, M. and Ghiasi, M. 2015. Survey on fungal infection of freshwater aquarium fish in Golestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 9(2):45-50. In Farsi.

Saeedi, L. 2002. Rich resources of seas in Iran. Payam-e Darya, Tehran11(109):4 pp. (www.netiran.com/Htdocs/WeeklyJournal/Economy/wj01133.html, downloaded 12 February 2002).

Saeedi Saravi, S. S., Karami, B., Karami, S. and Shokrzadeh, M. 2012. Evaluation of metal pollution in fish and water collected from Gorgan coast of the Caspian Sea, Iran. Bulletin of Environmental Contamination and Toxicology, 89(2):419-423.

Saeedi Saravi, S. S. and Shokrzadeh, M. 2013. Heavy metals contamination in water and three species of most consumer fish sampled from Caspian Sea, 2011. Environmental Monitoring and Assessment, 185(12):10333-10337.

Saeidi, M., Abesi, A. and Jamshidi, A. 2010. Assessment of heavy metal and oil pollution of sediments of south eastern Caspian Sea using indices. Journal of Environmental Studies, 36(53):21-38. In Farsi.

Saemi Kamsari, M., Mousavi Sabet, H., Sattari, M. and Eagderi, S. 2018. Estimation of status factor and length-weight relationship of *Garra persica* population from Hormozgan basin. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Saemi-Komsari, M., Mousavi-Sabet, H., Sattari, M., Eagderi, S., Vatandoust, S. and Doadrio, I. 2020. Descriptive osteology of *Garra rossica* (Nikolskii, 1900). FishTaxa, 16:19-28.

Saemi-Komsari, M., Mousavi-Sabet, H., Sattari, M., Eagderi, S., Vatandoust, S. and Salehi, M. 2021. Comparison of morphometric characteristics of two populations of *Garra rufa* from Persian Gulf and Hormoz basins. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Safaee, S. 2005. *Carassius auratus* (Linnaeus, 1758) as a (*sic*) invasive specie in Anzali Lagoon. Borok II, International Workshop, Invasions of Alien Species in Holarctic, 27 September-1 October 2005, Borok (abstract).
Safaeian, Sh., Hosseiny, H., Esmaili, A., Moghaddam, Z. and Vakili Amini, H. 2009. A consideration on against antibiotic and heavy metals resistance in isolated bacteria from intestine organ of Anzali Lagoon's *Cyprinus carpio*. Journal of Marine Science and Technology Research, 4(2):61-72. In Farsi.
Safahieh, A., Jaddi, Y., Movahedinia, A. A., Hallajian, A. and Dajandian, S. 2018. Determination range finding and median lethal concentration range (LC_{50} 96h) organophosphate pesticide diazinon on the Caspian Sea bream fish (*Abramis brama*). Journal of Marine Sciences and Technology, 17(2):70-81. In Farsi.
Safaian, N. A. and Shokri M. 2003. Ab-bandans or ponds of Mazandaran. Journal of Environmental Studies, 29(31):47-70. In Farsi.
Safari, A. and Ghafourian, M. H. 2009. Study of two human infectious bacteria in the kapoors (common carp) intestine in province Khorasan Razavi. Journal of Animal Biology, 2(1):51-55. In Farsi.
Safari, M., Cheleh Mal, M. and Mesbah, M. 2015. Effects of *Aloe vera* extract on hematological indices of *Barbus grypus*. New Technologies in Aquaculture Development (Journal of Fisheries), 9(2):25-34. In Farsi.
Safari, M., Cheleh Mal, M. and Mesbah, M. 2016. Effects of *Aloe vera* extract on growth rate of *Barbus grypus*. New Technologies in Aquaculture Development (Journal of Fisheries), 10(2):1-8. In Farsi.
Safari, M., Chelemel Dezfoul Nejad, M., Mesbah, M. and Jangaran Nejad, A. 2019. Effects of *Aloe vera* extract on growth and some hematological parameters of shirbot, *Tor grypus* (Heckel, 1843). Iranian Journal of Fisheries Sciences, 18(3):445-456.
Safari, O., Bagheri Dorbadam, J. and Naserizadeh, M. 2014. Study of plasma sex steroid hormones in female snow trout (*Schizothorax pelzami*) within a year. Journal of Veterinary Research, 69(4):423-430. In Farsi.
Safari, O. and Boldaji, F. A. 2008. Effect of dietary lipid level on growth, feed utilization and body composition by juvenile grass carp (*Ctenopharyngodon idella*). Pajouhesh va Sazandegi, 20(3)(76):109-117. In Farsi.
Safari, O. and Sarkheil, M. 2018. Dietary administration of eryngii mushroom (*Pleurotus eryngii*) powder on haemato-immunological responses, bactericidal activity of skin mucus and growth performance of koi carp fingerlings (*Cyprinus carpio* koi). Fish and Shellfish Immunology, 80:505-513.
Safari, R., Hoseinifar, S. H., Nejadmoghadam, S. and Khalili, M. 2017a. Non-specific immune parameters, immune, antioxidant and growth-related genes expression of common carp (*Cyprinus carpio* L.) fed sodium propionate. Aquaculture Research, 48(8):4470-4478.
Safari, R., Hoseinifar, S. H., Nejadmoghadam, S. and Khalili, M. 2017b. Apple cider vinegar boosted immunomodulatory and health promoting effects of *Lactobacillus casei* in common carp (*Cyprinus carpio*). Fish and Shellfish Immunology, 67:441-448.
Safari, R., Imanpour, M. R., Jafari, V. and Negadmoghadam, S. 2020. The effects of dietary administration on non alkohalic (*sic*) beer concentrate on expression of genes related to growth and skin mucus immunity in common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 14(1):39-55. In Farsi.
Safari, R., Imanpour, M. R. and Shaabanpour, B. 2008. Study of changing of chemical muscle

content during maturation in *Cyprinus carpio* (Linnaeus, 1758) (Cyprinidae). Pajouhesh va Sazandegi, 77(4):63-69. In Farsi.

Safari, R., Imanpour, M. R. and Shaabanpour, B. 2009. The effect of maturity stages on chemical compositions of muscles of *Rutilus frisii kutum* Kamenskii, 1901 in Gorgan Bay. Journal of Agricultural Sciences and Natural Resources, 16(1):28-34. In Farsi.

Safari, R. and Khandagi, A. 1999. Evaluation and isolation of *Clostridium botulinum* type E from fresh and smoked *Cyprinus carpio*, *Rutilus frisii kutum* and *Hypophtalmicthys* (*sic*) *molitrix*. Iranian Scientific Fisheries Journal, 7(4):19-26, 3. In Farsi.

Safari, R., Nejadmoghaddam, S., Hosseinifar, S. H. and Jafarnodeh, A. 2017. Effects of dietary sodium propionate on hematological and serum biochemical indices in common carp (*Cyprinus carpio*). Journal of Animal Environment, 9(3):203-210. In Farsi.

Safavi, F., Bagheri, T. and Shahbazi Naserabad, S. 2019. Effect of synbiotic biomin imbo (Biomin Imbo®) on hematological indices, growth, feed efficiency, carcass composition and survival of Caspian kutum (*Rutilus frisii kutum*). Journal of Aquaculture Development, 12(4):71-82. In Farsi.

Safavi, F. and Poorbagher, H. 2015. Using model-based clustering and hotelling's T2 to investigate size-specific morphologic changes of *Capoeta* in the Kordan River. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 126.

Safavi, F., Poorbagher, H., Javanshir, A. and Eagderi, S. 2015. Effect of different concentration of cypermethrin on gill of *Capoeta damascina* (Valenciennes, 1842). Journal of Aquatic Ecology, Hormozgan University, 4(4):88-95. In Farsi.

Safavi, F., Poorbagher, H., Javanshir Khoei, A., Eagderi, S. and Shahbazi, S. 2016. Effects of sub-acute cypermethrin on some hematological parameters of *Capoeta damascina* (Valenciennes, 1842). Journal of Aquatic Ecology, Hormozgan University, 5(4):1-11. In Farsi.

Saffar Shargh, A., Zakipour Rahimabadi, E., Alizadeh Doughikollaee, E. and Gheybi, F. 2018. Functional properties of protein extracted from crucian carp, using acidic and basic isoelectric solubilization/precipitation method. Journal of Fisheries Science and Technology, 7(1):17-23. In Farsi.

Safikhani, H., Nilsaz, M., Sabz-Alizadeh, S. and Esmaeili, F. 1998. Final report of limnological study of Karun River (Bandeghir to Khorramshahr). Iranian Fisheries Research Organization, Tehran. 56 pp. In Farsi.

Saghaee, R., Motamedzadegan, A. and Rezaei, M. 2013. The effect of microbial transglutaminase enzyme on the emulsifying properties of protein extracted from fish (*Hypophthalmichthys molitrix*). Journal of Food Technology and Nutrition, 10(2):19-26. In Farsi.

Saghali, M., Baqraf, R., Hosseini, S. A., Nejatkhah Manavi, P. and Moghimi Tilemi, B. 2012. Heavy metals (Zn, Pb, Cd and Cr) in fish, water and sediments of southern Caspian Sea, Iran. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 607-618.

Saghali, M., Baqraf, R., Patimar, R., Hosseini, S. A. and Baniemam, M. 2014. Determination of heavy metal (Cr, Zn, Cd and Pb) concentrations in water, sediment and benthos of the Gorgan Bay (Golestan province, Iran). Iranian Journal of Fisheries Sciences, 13(2):449-445.

Sahandi, J., Jafarian, H., Roozbehfar, R., Babaei, S. and Dehestani, M. 2012. The use of two enrichment forms (*Brachionis plicatilis* enrichment and rearing water enrichment) with probiotic bacilli spore on growth and survival of silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Veterinary Research, Shiraz University, 13(4):289-295.

Sahandi, J., Jafaryan, H., Dehghan, M., Adineh, H. and Shohreh, P. 2012. Direct inoculation of Bacillus to rearing fish tanks effect on growth performance of two carp species fed with *Artemia* sp. World Applied Sciences Journal, 20(5):687-690.

Sahandi, J., Jafaryan, H. and Tadiri, C. 2012. Nutritional effect of *Saccharomyces cerevisiae* extract on growth enhancement with adding on diet during first month feeding of *Cyprinus carpio*. The First International Conference on Larviculture in Iran and International Workshop on Replacement of Fish/Meal Oil with Plant Sources in Aquatic Feed, Iran-Larvi 2012, 11-12 December 2012, Karaj, Iran, pp. 626-632.

Sahandi, J., Shohreh, P. and Jafariyan, H. 2011. *Argulus* (*Argulus pellucidus*) parasite, usual disease of gold fishes. VIII International Symposium of Fish Parasites, 26-30 September 2011, Viña del Mar, Chile (abstract).

Sahari, M. A., Ahmadnia, A., Barzegar, M. and Noorolahi, Z. 2014. Vitamin loss during frozen storage of *Liza aurata* (Risso, 1810), *Cyprinus carpio* L., 1758, *Clupeonella cultriventris caspia* (Nordmann, 1840), *Rutilus frisii kutum* (Kamenskii, 1901) and *Sander lucioperca* (L., 1758). Journal of Applied Ichthyology, 30(2):366-371.

Sahli, M., Paknezhad, H., Hoseinifar, S. H., Sudagar, M., Mazandarani, M. and Sanchooli, H. 2020. The effects of different levels of low molecular weight sodium alginate on growth performance and mucus immune parameters in common carp (*Cyprinus carpio*). Journal of Animal Environment, 12(2):195-202. In Farsi.

Sahraei, H., Hedayati, A. A., Marivani, L. and Rezaei, K. 2020. Histological alterations in the brain and intestine of exposed common carp *Cyprinus carpio* Linnaeus, 1758 to iron and zinc oxide nanoparticles. Journal of Applied Ichthyological Research, 7(4):49-63. In Farsi.

Sahraei, H., Hedayati, S. A. A., Marivani, L. and Rezaei, K. 2017. Investigating changes in common carp *Cyprinus carpio* Linnaeus, 1758 muscle and liver enzymes fed with iron and zinc oxide nanoparticles. Journal of Applied Ichthyological Research, 5(2):79-96. In Farsi.

Sahraei, H., Pirali, A., Ayatollahi, F., Farvadin, S. and Hedayati, A. A. 2019. The prebiotic effects of diet galactooligosaccharide on the growth performance and intestinal morphology of *Carassius auratus gibelio*. Journal of Animal Biology, 11(3):33-43. In Farsi.

Sahraei, H., Pirali Zefrehei, A. R., Azizi, S. and Hedayati, S. A. 2021. Study of Spirlin fish populations (*Alburnoides tabarestanensis*) using morphological traits in rivers of Golestan province. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.

Sahraei, H., Pouladi, M. and Hedayati, A. 2020. The effect some growth factors of common carp (*Cyprinus carpio*, Linnaeus, 1758) of feeding with different sources of zinc and iron (nano-particles). Journal of Utilization and Cultivation of Aquatics, 9(3):109-121. In Farsi.

Sahraei, H., Zohieri, F., Imanpour, M. R. and Pirali Zefrei, A. R. 2017. Nutritional effects of black powder seeds (*Nigella sativa*) on antibacterial activity and safety mucus indicators

Caspian roach (*Rutilus caspicus*). Journal of Fisheries (Iranian Journal of Natural Resources), 69(4):443-451. In Farsi.

Sahreian, Z., Esmaeili, H. R., Sampour, M. and Sadeghinejad, E. 2008. Systematic comparison of *Capoeta damascina* (Actinopterygii: Cyprinidae) in Dez and Kashkan basins in Lorestan province. First National Conference of Fisheries Sciences, Lahijan, Gilan, 6-8 May 2008 (abstract).

Sahrhage, D. 1999. Fischfang und Fischkult im alten Mesopotamien. Peter Lang, Frankfurt am Main. 241 pp.

Sahrhage, D. and Lundbeck, J. 1992. A History of Fishing. Springer-Verlag, Berlin. viii + 348 pp.

Saiad Borani, M. 2001. The role of restocking bream for improvement of the natural stock. Iranian Scientific Fisheries Journal, 9(4):27-38. In Farsi.

Saiad Bourani, M. 2018. Multi-species culture of black carp (*Mylopharyngodon piceus*) with Chinese carp fish in Iran. Journal of Aquaculture Development, 12(2):75-87. In Farsi.

Saiad Bourani, M. and Ghaninejad, D. 2004. Stock assessment of *Capoeta capoeta* in Mako Reservoir. Iranian Scientific Fisheries Journal, 13(3):115-128. In Farsi.

Saifali, M. and Yazdani Moghaddam, F. 2014. Minimum-spanning network of spirlin (*Alburnoides* sp.) in the south Caspian Sea. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Saifali, M., Yazdani Moghaddam, F., Aliabadian, M. and Esmaeili, H., R. 2012. Mitochondrial genetic and truss network differentiation of spirlin (Actinopterygii: Cyprinidae) in the Caspian Sea basin of Iran. XIV European Congress of Ichthyology, Liège, Belgium, 3-8 July 2012 (poster).

Saitoh, K., Sado, T., Mayden, R., Hanzawa, N., Nakamura, K., Nishida, M. and Miya, M. 2006. Mitogenomic evolution and interrelationships of the Cypriniformes (Actinopterygii: Ostariophysi): the first evidence toward resolution of higher-level relationships of the world's largest freshwater fish clade based on 59 whole mitogenomic sequences. Journal of Molecular Evolution, 63(6):826-841.

Sajaadyeh, M. A. 1995. Water and its importance in Iranian new year traditions. Abzeeyan, Tehran, 5(9):10-13, III. In Farsi.

Sajjadi, M. S. 1982. Qanat/kariz: storia, tecnica construttiva ed evoluzione. Quaderni della Sezione archeologica dell'Istituto italiano di cultura, Teheran, 1:xxiii + 172 pp., 30 plates.

Sakhaei, N., Doostshenas, B. and Mobed, P. 2018. Determining the Bahmanshir River health and biodiversity using Nygaard-Palmer and Saprobic indices. Iranian Scientific Fisheries Journal, 26(5):153-166. In Farsi.

Sakizadeh, M., Esmaeili Sari, A., Abdoli, A., Bahramifar, N. and Hashemi, S. H. 2012. Determination of polychlorinated biphenyls and total mercury in two fish species (*Esox lucius* and *Carassius auratus*) in Anzali Wetland, Iran. Environmental Monitoring and Assessment, 184(5):3231-3237.

Sakizadeh, M., Nikokhoy, S. and Karimi, S. 2015. An assessment of water quality and classification in Karaj River. International Bulletin of Water Resources and Development, 3(3):34-42.

Salahi Kojoure, A. A. 1997. Environmental aspects of rain quality. XI World Forestry Congress, 13 to 22 October 1997, Antalya, Turkey, 1 p (abstract).

Salamat, N., Alboughobish, N., Hashemi Tabar, M., Mesbah, M. and Ahangarpour, A. 2009. Pituitary primary cell culture of common carp (*Cyprinus carpio*) and evaluation of its secretion effect on endocrine activity of incubated ovarian follicles. Iranian Journal of Veterinary Research, Shiraz University, 10(1)(26):61-65.

Salamat, N., Erfani Majd, N., Hashemitabar, M., Mesbah, M. and Ahangarpoor, A. 2010. Isolation of common carp ovarian follicular cells and evaluation of their endocrine activity in primary cell culture. Iranian Journal of Fisheries Sciences, 9(2):305-314.

Salamat, N., Erfani Majd, N., Hashemitabar, M., Mesbah, M. and AhangarPour, A. 2012. A comparative study of synthetic carp GnRH and carp pituitary homogenate effects on in vitro steroidogenesis of oocytes in common carp (*Cyprinus carpio*). Iranian Journal of Fisheries Sciences, 11(2):394-404, VXI.

Salamat, N., Khalifi, K. and Movahedinia, A. 2016. Health concerns related to consumption of fish from Anzali Wetland. Clean - Soil, Air, Water, 44(2):115-123.

Salaramoli, J. 2005. The influence of heavy metal pollution due to industrial and agricultural activities in fish ponds. Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Salaramoli, J., Ghiasi, F. and Mirzargar, S. S. 2005. Influence of zeolite (clinoptilolite) on the level of cadmium and some water quality parameters in common carp (*Cyprinus carpio*) pond water exposed to sublethal concentration of cadmium. Sixth Symposium on Diseases in Asian Aquaculture (DAA VI), Conference Programme, 25-28 October 2005, Columbo Plaza Hotel, Columbo, Sri Lanka (title).

Salati, S. and Moore, F. 2010. Assessment of heavy metal concentration in the Khoshk River water and sediment, Shiraz, Southwest Iran. Environmental Monitoring and Assessment, 164(1-4):677-689.

Salati, A. P., Baghbanzadeh, A., Soltani, M., Peyghan, R. and Riazi, Gh. 2010. The response of plasma glucose, lactate, protein and hematological parameters to osmotic challenge in common carp (*Cyprinus carpio*). Iranian Journal of Veterinary Medicine, 4(1):49-52.

Salati, S. A., Baghbanzadeh, A. and Movahedinia, A. 2011. Immunolocalization of Na^+- K^+ ATPase in response to different salinity levels in gills of *Cyprinus carpio*. Journal of Marine Sciences and Technology, 9(4):76-82. In Farsi.

Salavatian, S. M., Abbasi, K. and Abedini, A. 2016. Identification, abundance and length, weight and age composition of fishes in Arasbaran Reservoir. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Salavatian, S. M., Abedini, A., Mirzajani, A. R. and Pour Gholami Moghadam, A. 2017. Identification and determination of macrobenthic biomass for aquaculture in Lake Asbaran Dam Reservoir. Journal of Aquaculture Development, 11(3):41-51. In Farsi.

Salavatian, S. M., Aliyev, A. R., Quliyev, Z. M., Nezami Baluchi, Sh. A. and Abbasi Ranjbar, K. 2012. Aquatic fauna of Laar Reservoir. New Technologies in Aquaculture Development (Journal of Fisheries), 6(1):1-18. In Farsi.

Salehi, H. 1999. A strategic analysis of carp culture development in Iran. Ph.D. Thesis, Institute of Aquaculture, University of Stirling. xix + 328 pp.

Salehi, M. 2001a. Application of adaptive sampling in fishery part 1: adaptive cluster sampling and its strip designs. Iranian Journal of Fisheries Sciences, 3(1):55-76.

Salehi, M. 2001b. Application of adaptive sampling in fishery part 2: truncated adaptive cluster sampling designs. Iranian Journal of Fisheries Sciences, 3(1):77-84.

Salehi, H. 2003a. Carp culture sector in Iran: an economic analysis of farmed production. World Aquaculture 2003, 20-23 May, Salvador, Brazil (title).
Salehi, H. 2003b. Economic analysis of production and releasing of kutum roach, *Rutilus frisii kutum*, fingerling in Iran. Iranian Journal of Marine Sciences, 2(1):35-46. In Farsi.
Salehi, H. 2003c. The needs of research on aquaculture economics in Iran. Iranian Scientific Fisheries Journal, 11(4):75-96. In Farsi.
Salehi, H. 2004a. Carp culture in Iran. Aquaculture Asia, 9(2):8-11.
Salehi, H. 2004b. An economic analysis of carp culture production cost in Iran. Iranian Journal of Fisheries Sciences, 4(1):1-24, 119.
Salehi, H. 2006. An analysis of the consumer market for carp and carp products in Iran. Iranian Journal of Fisheries Science, 5(2):83-110.
Salehi, H. 2007. New opportunities for fish market development in Iran. Fish Marketing Conference, 26-29 November 2007, Kish Island, Iran. 45 pp. In Farsi.
Salehi, H. 2008a. Comparative economics of kutum (*Rutilus frisii kutum*) fingerling production and releasing over 2001-2003 in north of Iran. Pajouhesh va Sazandegi, 20(4)(77):131-140. In Farsi.
Salehi, H. 2008b. Stock enhancement initiative in the Caspian - the Iranian way. INFOFISH International, 5:59-62.
Salehi, H. 2009. Comparative analysis of carp farming costs in Iran, in 1996 and 2001. Iranian Journal of Fisheries Sciences, 8(2):185-200.
Salehi, H. 2011a. Analysis of factor costs contribution change for fingerling production of kutum fish (*Rutilus frisii kutum* Kamensky, 1901) in Iran. Iranian Journal of Fisheries Sciences, 10(4):727-739, XV.
Salehi, M. 2011b. Introduction to fishing gears and methods of fishing. Tehran. 215 pp.
Salehi, H. 2016. The current economics of fisheries (fishery and aquaculture) in Guilan, Mazandaran and Golestan provinces. Iranian Fisheries Science Research Institute, Tehran. 168 pp. In Farsi.
Salehi, M. and Mokhtari, A. 2008. An investigation of fish consumption attitude among nutrition experts in Iran. Iranian Scientific Fisheries Journal, 17(1):79-90. In Farsi.
Salehi, H. and Momen Nia, M. 2006. The benefits of fish and rice integrated culture in Iran. Iranian Scientific Fisheries Journal, 15(3):97-108. In Farsi.
Salehi Borban, S., Gharachorloo, M. and Zamani, F. 2017. Check amount of heavy metals in muscle and fish oil *Rutilus frisii kutum*, *Clupeonella cultriventris* and *Liza saliens*. Journal of Food Hygiene, 6(4):75-88. In Farsi.
Salehinia, D., Eagderi, S., Khorasani, N. A. and Zamani Faradonbe, M. Z. 2016. Impact of Sangban Dam on the morphological characteristics of siah mahi (*Capoeta gracilis*, Keyserling, 1864) populations using traditional and geometric morphometric techniques. Journal of Animal Environment, 8(2):97-104. In Farsi.
Salemi, H. R. and Heydari, N. 2006. Assessment of water supply and use in the Zayandeh-Rud River basin, Iran. Iran Water Resources Research, 2(1):72-76. In Farsi.
Salemi, H. R., Heydari, N. and Rust, H. M. 2005. Water resources development and water utilization in the Zayandeh Rud basin, Iran. The Fourth International Iran and Russia Conference 'Agriculture and Natural Resources', September 8-10, Shahr-e Kord, Iran, pp. 1297-1303.

Salemi, M. and Hosseini Alhashemi, A. 2017. Bioaccumulation of heavy metals (cadmium, chromium, nickel zinc), in *Cyprinus carpio* fish. Journal of Animal Biology, 9(4):35-45. In Farsi.

Salemi, M. and Sayahi, Z. 2018. Assessment of possibility of occurrence of non-cancer effects of cadmium, nickel, lead, chromium and zinc caused by the consumption of *Barbus grypus* fish in Mahshahr City. Journal of Animal Biology, 10(4):33-43. In Farsi.

Saligheh Zadeh, R., Yavari, V., Mousavi, S. M. and Zakeri, M. 2014. Effect of different levels of dietary supplementation of *Spirulina platensis* on some growth, feeding indices and body composition of benny *Mesopotamichthys sharpeyi* (Günther, 1874) fingerlings. Journal of Oceanography, 5(18):21-27. In Farsi.

Saligheh Zadeh, R., Yavari, V., Mousavi, S. M. and Zakeri, M. 2015. Effect of dietary supplement of *Spirulina platensis* on immune indices complement and lysozyme of benny fish (*Mesopotamichthys sharpeyi* (Günther, 1874). Journal of Aquatic Ecology, Hormozgan University, 5(1):44-54. In Farsi.

Salikhov, T. V., Kamilov, B. G. and Atadjanov, A. K. 2001. Ribi Uzbekistana (Fishes of Uzbekistan). Chinor ENK, Tashkent. 152 pp.

Salim, S. M. 1962. Marsh Dwellers of the Euphrates Delta. London School of Economics, Monograph on Social Anthropology, 23, University of London, The Athlone Press. x + 157 pp.

Salimi Manshadi, M. A., Amin, S. and Sadeghi, J. M. 1997. The economic feasibility of water conservation by ghanat outflow control in Yazd Province, Iran. Iranian Journal of Science and Technology, Transactions B: Technology, 21(4):407-416.

Salman, N. A., Ahmed, H. A. and Al-Rudaini, A. M. 1994. Gut morphology and intestinal coiling in four cyprinids species from Al-Hammar marshes, southern Iraq. Marina Mesopotamica, 8(1)(1993):153-165.

Salman, N. A., Ahmed, H. A. and Al-Rudainy, A. M. J. 1994. Gill rakers morphometry and filtering mechanism in four cyprinid species. Marina Mesopotamica, 8(1)(1993):25-43.

Salman, N. A., Al-Mahdawi, Gh. J., Kittan, S. A. S., Al-Rudainy, A. M. J. H. and Habah, M. K. 1995. Acclimation of common carp, bunni and gattan to the drainage water of Saddam River using concrete ponds. Marina Mesopotamica, 8(2)(1993):190-201.

Salmanian Ghahderijani, M., Hajimoradloo, A., Ghorbani, R. and Roohi, Z. 2015. The effects of garlic-supplemented diets on skin mucosal immune responses, stress resistance and growth performance of the Caspian roach (*Rutilus rutilus*) fry. Fish and Shellfish Immunology, 49:79-83.

Salmanmahine, A. and Safidiyan, S. 2013. A hydrological classification of International Wetlands of Iran. Environmental Researches, 3(6):45-56. In Farsi.

Salnikov, V. B. 1994. Formation of the fish population in the artificial hydrographic network of Turkmenistan (the Amudarya River basin), pp. 365-387. In: Fet, V. and Atamuradov, K. I. (Eds.). Biogeography and Ecology of Turkmenistan. Kluwer Academic Publishers, Dordrecht/Boston/London. viii + 650 pp.

Sal'nikov, V. B. 1995. Possible changes in the composition of the ichthyofauna after completion of the Karakum Canal in Turkmenistan. Journal of Ichthyology, 35(7):108-121.

Sal'nikov, V. B. 1998. Anthropogenic migration of fish in Turkmenistan. Journal of Ichthyology, 38(8):591-602.

Salonen, A. 1970. Die Fischerei im Alten Mesopotamien nach Sumerisch-Akkadischen Quellen. Eine Lexikalische und Kulturgeschichtliche Untersuchung. Annales Academiæ

Scientiarum Fennicæ, Ser. B, 166:1-314, tafs I-LI.
Samadani, A. A., Javanshir Khouei, A. and Jamili, Sh. 2009. Population distribution of bony fishes in less-than-ten-metre depths of Mazandaran coasts. Journal of Environmental Science and Technology, 11(2)(41):131-142. In Farsi.
Samadi Mirarkalaei, H. and Samadi Mirarkalaei, H. 2015. The explanation of the effective behavioral factors on innovation and entrepreneurship towards achievement of the fisheries' economic goals (a study in the Mazandaran Fisheries and Marine Organization). Journal of Utilization and Cultivation of Aquatics, 4(3):91-108. In Farsi.
Samadzadeh, P., Hamidian, A. H. and Eagderi, S. 2017. Acute effects, colloidal silver nanoparticles (AgNPs) on goldfish (*Carassius auratus*). 4th International Conference on Environmental Planning and Management, Tehran. 7 pp. In Farsi.
Samadzadeh, P., Hamidian, A. H. and Eagderi, S. 2018. Evaluation of resistance and adaptation of *Carassius auratus* fish as invasive species during chronic contact with AgNPs colloids. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Samaee, S. M., Mojazi-Amiri, B. and Hosseini-Mazinani, S. M. 2006. Comparison of *Capoeta capoeta gracilis* (Cyprinidae, Teleostei) populations in the south Caspian Sea river basin, using morphometric ratios and genetic markers. Folia Zoologica, Brno, 55(3):323-335.
Samaee, S.-M. and Patzner, R. A. 2011. Morphometric differences among populations of tu'ini, *Capoeta damascina* (Teleostei: Cyprinidae), in the interior basins of Iran. Journal of Applied Ichthyology, 27(3):928-933.
Samaee, S.-M., Patzner, R. A. and Mansour, N. 2009. Morphological differentiation within the population of siah mahi, *Capoeta capoeta gracilis* (Cyprinidae, Teleostei) in a river of the south Caspian Sea basin: a pilot study. Journal of Applied Ichthyology, 25(5):583-590.
Samarin, A. M., Kazemi, R., Nikbakhsh Golkhaily, J. and Policar, T. 2017. Survival rates associated with *in vitro* low-temperature storage of kutum (*Rutilus kutum*) eggs. Iranian Journal of Fisheries Sciences, 16(1):59-66.
Same, M., Imanpoor, M. R., Jafari, V. and Alishahie, A. 2016. Effects of chitosan prebiotic on the growth performance, hematological parameters, survival and resistance to salinity stress in common carp (*Cyprinus carpio*) fry. Journal of Animal Environment, 8(2):215-222. In Farsi.
Sanayei, Y., Ismail, N. and Talebi, S. M. 2009. Determination of heavy metals in Zayandeh Rood River, Isfahan-Iran. World Applied Sciences Journal, 6(9):1209-1214.
Sanchooli, H., Oragi, H., Keramat, A. S. and Jani Khalili, K. 2017. Effects of different protein restriction and realimentation on growth performance and body composition of fingerling common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 26(2):111-120. In Farsi.
Sanchooli, N., Khandan Barani, H. and Rahdari, A. 2017. Effect of different levels of the amino acid lysine on growth, feed efficiency and body composition of juvenile snow trout (*Schizothorax zarudnyi*). Journal of Experimental Animal Biology, 5(3):107-116. In Farsi.
Sanchooli, O., Moradloo, A. H. and Ghorbani, R. 2012. Measurement of alkaline phosphatase and lysozyme enzymes in epidermal mucus of different weights of *Cyprinus carpio*. World Journal of Fish and Marine Sciences, 4(5):521-524.
Sanford, B. 1975. Neur Lake limnological survey II - 1354, 19-28 Mordad 1354. Job Progress

Report, Fisheries and Aquatic Ecology Section, Department of the Environment, Tehran. 5 pp., 3 tabs., 4 figs.

Sarami, A. and Mokhtarian, B. 2015. Pisces and Iranian two-symbolic-fish pattern, *Herati*: A structural analysis of iconographic symbols and metaphorical expressions of bicorporal fish pattern. Studies in Visual Arts and Communication, 2(2):16 pp.

Saravani, M. and Keykhah, A. 2018. Analysis of price transmission in market of marine and farmed fish in north of Iran. Journal of Agricultural Economics Research, 9(4):209-230. In Farsi.

Saravi, M. 2015. Water quality assessment based on Hilsendorff biological diversity, Shannon-Wiener indices and environmental parameters in Tajan River. Journal of Fisheries Science and Technology, 3(4):43-55. In Farsi.

Sardar, Z. 1979. Iran faces an environmental crisis. Nature, London, 282(5734):441.

Saremi, N., Mousavi, S. M., Zakeri, M. and Zanguee, N. 2018. Effects of ethanolic extract of cumin seeds (*Cuminum cyminum*) on gastric enzymes and some serological parameters of *Cyprinus carpio* fingerlings. Journal of Aquaculture Development, 12(4):51-69. In Farsi.

Sargeran, P., Bakhtiyari, M., Abdoli, A., Coad, B. W., Sarvi, K., Lishi, M. R. and Hajimoradloo, A. 2008. The endemic Iranian cave-fish, *Iranocypris typhlops*: two taxa or two forms based on the mental disc? Zoology in the Middle East, 44(1):67-74.

Sarhadi, A. and Soltani, S. 2013. Determination of water requirements of the Gavkhuni wetland, Iran: A hydrological approach. Journal of Arid Environments, 98:27-40.

Sarhadi, I., Alizadeh Doughikollaee, E., Ahmadifar, E. and Adineh, H. 2019. Effect of dietary supplementation of *Artemisia annua* extract on some hematological and serum biochemical parameters of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 28(2):1-11. In Farsi.

Sarı, H. M., Balık, S., Ustaoğlu, M. R. and Ilhan, A. 2008. Population structure, growth and mortality of *Carassius gibelio* (Bloch, 1782) in Buldan Dam Lake. Turkish Journal of Fisheries and Aquatic Sciences, 8(1):25-29.

Sarig, S. 1966. Synopsis of biological data on common carp Cyprinus carpio (Linnaeus), 1758 (Near East and Europe). Food and Agriculture Organization, Rome, Fisheries Synopsis, 31.2:iii + 35 pp.

Sarker, A. L., Al-Nasiri, S. K. and Hussein, S. A. 1980. Diurnal fluctuations in the physico-chemical conditions of the Shatt al-Arab and the Ashar Canal. Proceedings of the Indian Academy of Sciences (Animal Sciences), 89(2):171-181.

Sarkhosh, S., Patimar, R., Jafarian, H., Ghorbani, R. and Golzarianpour, K. 2015a. Qualitative assessment of the Haraz River by measuring the physical and chemical factors. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 195.

Sarkhosh, S., Patimar, R., Jafarian, H., Ghorbani, R. and Golzarianpour, K. 2015b. Measurement of water quality parameters to assess the Haraz river pollution. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 196.

Sarkhosh, S., Patimar, R. and Jafaryan, H. 2017. Effects of Qezel Kaj trout farm on physical and chemical characteristics of Haraz River water. New Technologies in Aquaculture Development (Journal of Fisheries), 11(1):51-60. In Farsi.

Sarnthein, M. 1972. Sediments and history of the postglacial transgression in the Persian Gulf and northwest Gulf of Oman. Marine Geology, 12(4):245-266.

Sarpanah, A. 2019. Investigating the effect of the stress of cavity (*sic*, captivity) on changes in physiological parameters effective in the reproduction of Caspian kutum. Journal of Animal Environment, 11(3):127-134. In Farsi.

Sarpanah, A., Abbasi, K. and Mehdizadeh, Gh. 2019. The role of rivers of western region of Guilan Province in rebuilding of anadromous fishes of Caspian Sea. Journal of Aquatic Caspian Sea, 4(1):50-61. In Farsi.

Sarpanah, A., Abbasi, K., Rezvani, S. and Sakari, M. 2004. A survey of fish species diversity in the biggest river of the southern part of Caspian Sea, Sefidroud River. Biology in Asia International Conference, Singapore, 7-10 December 2004 (abstract).

Sarpanah, A., Gafouri, Z. and Abbasi, K. 2021. Comparative study of fecundity in *Acanthobrama urmianus* (Gunther, 1899) between Mahabadchai and Siminerud rivers (Lake Urmia basin). Iranian Journal of Fisheries Sciences, 30(2):147-159.

Sarpanah, A., Monsef Kasmaie, H., Yasemi, M. and Abedi, M. 2020. Effects of cortisol treatment and ovaprim treatment on sex steroid hormones, plasma and oocyte cortisol content and ovulation induction in Caspian kutum, “Rutilus frisii (Kamensky, 1901)” broodstocks. Iranian Journal of Fisheries Sciences, 19(2):715-725.

Sartaj, M., Fathollahi, F. and Filizadeh, Y. 2005. An investigation of the evolution of distribution and accumulation of heavy metals (Cr, Ni, Cu, Cd, Zn and Pb) in Anzali Wetland’s sediments. Iranian Journal of Natural Resources, 58(3):623-634. In Farsi.

Sary, A., Velayatzadeh, M., Azarpour, M. and Bozorgpour, A. 2011. Comparative survey of chemical composition in muscle of farmed common carp (*Cyprinus carpio*) and Indian white shrimp (*Feneropenaeus* (*sic*) *indicus*). Journal of Wetland Ecobiology, 2(7):57-63. In Farsi.

Şaşı, H. 2008. The length and weight relations of some reproduction characteristics of Prussian carp, *Carassius gibelio* (Bloch, 1782) in the South Aegean region (Aydın Turkey). Turkish Journal of Fisheries and Aquatic Sciences, 8(1):87-92.

Sattari, M. 1996. Parasites of some bony fish species of Anzali Wetland from the southwest of the Caspian Sea. Scientific Report to the University of Guilan, Rasht. 53 pp. In Farsi.

Sattari, M. 2004. The occurrence and intensity of *Eustrongylides excisus* (Nematoda: Dioctophymidae) in some bony fish species of Caspian Sea and its basin. Caspian Journal of Environmental Sciences, 2(1):9-12.

Sattari, M. and Faramarzi, N. 1997a. A survey on infection of fishes of Anzali Lagoon with parasites of genus *Caryophyllaeus*. Iranian Fisheries Scientific Journal, 5(4):63-72, 7. In Farsi.

Sattari, M. and Faramarzi, N. 1997b. A study on infection of fishes of Anzali wetland with parasites of genus *Caryophyllaeus*. Pajouhesh va Sazandegi, 5(4):763-72. In Farsi.

Sattari, M., Imanpour, J., Bibak, M., Forouhar Vajargah, M. and Khosravi, A. 2019. Investigation of metal element concentrations in tissue of *Rutilus frisii* in the southwest Caspian Sea. Iranian Scientific Fisheries Journal, 28(3):149-161. In Farsi.

Sattari, M., Khara, H., Nezami, S., Roohi, J. D. and Shafii, S. 2005. Occurrence and intensity of some nematodes in the bonyfish species of the Caspian Sea and its basin. Bulletin of the European Association of Fish Pathologists, 25(4):166-178.

Sattari, M., Khara, B., Roohi, J. D. and Shafii, S. 2004. Occurrence and intensity of some nematodes in the bony fish species of the Caspian Sea and its basin. Biology in Asia

International Conference, Singapore, 7-10 December 2004 (abstract).
Sattari, M., Majidi, S., Imanpour Namin, J., Bibak, M., Forouhar Vajargah, M. and Nasrollahzadeh, A. 2020. Investigating the relationship between some element concentrations in liver and muscle of *Vimba persa* and growth indices during different seasons in the southwest coasts of the Caspian Sea. Journal of Aquaculture Development, 14(3):43-53. In Farsi.
Sattari, M., Mokhayer, B., Khara, H., Nezami, S. and Shafii, S. 2007. Occurrence and intensity of parasites in some bonyfish species of Anzali wetland from the southwest of the Caspian Sea. Bulletin of the European Association of Fish Pathologists, 27(2):54-60.
Sattari, M., Mokhayer, B., Khara, H., Roohi, J. D. and Nezami, S. 2008. Parasitic worms of some bony fish species from the southern shore of the Caspian Sea. Bulletin of the European Association of Fish Pathologists, 28(1):16-21.
Sattari, M., Roostaei, M. and Shafii, S. 2001. Occurrence and intensity of *Raphidascaris acus* (Nematoda: Anisakidae) in some fish species of Anzali wetland in the southwest of the Caspian Sea. Pajouhesh va Sazandegi, 14(3)(52):79-83. In Farsi.
Sattari, M., Shafiei, S., Daghigh Roohi, J. Abdolahpour Biria, H. and Bekhsat, N. 2002. Occurrence and intensity of *Eustrongylides excisus* (L.) (Nematoda: Dioctophymidae) from some bony fish species in the Caspian Sea and its basin. Journal of the Faculty of Veterinary Medicine, University of Tehran, 57(1):37-41. In Farsi.
Saud, H. A. 1997. The biology of two cyprinid fishes (*Acanthobrama marmid* and *Alburnus sellal*) in Karmat Ali River, Basrah. M.Sc. Thesis, Basrah University. 80 pp. In Arabic.
Sauvage, H. E. 1882. Catalogue des poissons recueillis par M. E. Chantre pendant son voyage en Syrie, Haute-Mésopotamie, Kurdistan et Caucase. Bulletin de la Société philomathique de Paris, 6:163-168.
Sauvage, H. E. 1884. Notice sur la faune ichthyologique de l’ouest de l’Asie et plus particulièrement sur les poissons recueillis par M. Chantre pendant son voyage dans cette region. Nouvelles Archives du Muséum d’Histoire naturelle, Paris, 2 sèrie, 7:1-42, pl. 1-3.
Savenkova, T. P. 1985. Osobennosti Skata Molodi Turkmenskoi Vobly v Nizov’yakh R. Atrek i Nagula v Yugo-vostochnoi Chasti Kaspiiskogo Morya (Peculiarities of descent of young Turkmen Caspian roach in the Atrek River lower reaches and graziery in the south-eastern part of the Caspian Sea). Izvestiya Akademii Nauk Turkmenskoi SSR (Seriya Biologicheskikh Nauk), 1985(2):41-47.
Savenkova, T. P. 1990. Dinamika Promyslovykh Ulovov i Struktura Perestovogo Stada Vobly Yugo-vostochnogo Kaspiya (Dynamics of marketable catches and structure of the spawning stock of Caspian roach of the south-eastern Caspian Sea). Izvestiya Akademii Nauk Turkmenskoi SSR (Seriya Biologicheskikh Nauk), 1990(1):47-54.
Savenkova, T. P. 1994. Distribution and characteristics of the biology of young-of-the-year vobla, *Rutilus rutilus caspicus*, in the southeastern Caspian Sea. Journal of Ichthyology, 34(3):28-38.
Savenkova, T. P. and Asanov, A Yu. 1988. Nablyudeniya za skatom molodi ryb v nizov’yakh reki Atrek [Observations on the downstream migration of young fish in the lower Atrek River]. Voprosy Ikhtiologii, 28(4):649-656.
Savvaitova, K. A., Shanin, A. Yu. and Maksimov, V. A. 1987. Intraspecific differentiation of Schizopygopsis stoliczkai Steindachner, 1866, from Pamir lakes. Bulletin of Moscow University (Biological Sciences), 42(2):8-16.

Savvaitova, K. A., Shanin, A. Yu. and Verigina, I. A. 1989. The formation and population structure of the false osman, Schizopygopsis stoliczkai, in Pamir. Journal of Ichthyology, 29(1):136-147.
Sayad Borani, M., Nezami, Sh. and Hassanzadeh Keyabi, B. 2001. Biological study and population dynamics of *Carassius auratus gibelio* in Anzali Lagoon. Iranian Scientific Fisheries Journal, 10(3):57-70, 4. In Farsi.
Sayadi, M., Rezaei, M., Rashki Ghaleno, O., Afsari, K. and PoorMollaeib, N. 2015. Natural and factor distribution of heavy metals in sediments of Chah Nimeh reservoirs of Sistan, Iran. Ecopersia, 3(2):1003-1012.
Sayadi, M. H., Pavlaki, M D., Martins, R., Mansouri, B., Tyler, C. R., Kharkan, J. and Shekari, H. 2020. Bioaccumulation and toxicokinetics of zinc oxide nanoparticles (ZnO NPs) co-exposed with graphene nanosheets (GNs) in the blackfish (*Capoeta fusca*). Chemosphere, 269:128689.
Sayahan, S., Imanpoor, M. R. and Panahi Sahebi, H. 2018. Effects of sesame meal replacement with fish meal on growth indices, carcass quality and blood parameters in Caspian Sea whitefish. Journal of Animal Environment, 10(3):221-228. In Farsi.
Sayari, H. and Rahmani, H. 2015. Length-weight relationship of *Capoeta damascina* from Rudbal River, Fars Province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 150.
Sayyad Bourani, M. 2016. Determination of suitable size of *Rutilus frisii kutum* for releasing by evaluation of osmotic regulation ability. Iranian Fisheries Science Research Institute, Tehran. 54 pp. In Farsi.
Sayyad Bourani, M., Ahmadnezhad, M., Maghsoudiyeh Kohan, H., Dajandiyan, S. and Sharifiyan, M. 2014. Chloride cell frequency and distribution in the gill of kutum fries, *Rutilus frisii*, exposure to Caspian Sea water salinity. Journal of Aquaculture Development, 8(2):35-44. In Farsi.
Sayyadzadeh, G. and Esmaeili, H. R. 2014. The freshwater ecoregions of Iran. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Sayyadzadeh, G., Esmaeili, H. R., Abbasi, K. and Coad, B. W. 2015. Re-validation of *Gonorhynchus adiscus* and *G. diplochilus* (Teleostei: Cyprinidae) using morphological and molecular data. Zoology in the Middle East, 61(4):349-361.
Sayyadzadeh, G., Esmaeili, H. R. and Freyhof, J. 2015. *Garra mondica*, a new species from the Mond River drainage with remarks on the genus *Garra* from the Persian Gulf basin in Iran (Teleostei: Cyprinidae). Zootaxa, 4048(1):75-89.
Sayyadzadeh, G., Esmaeili, H. R., Ghasemian, S., Mirghiyasi, S., Parsi, B., Zamanpoore, M. and Akhlaghi, M. 2016. Co-invasion of anchor worms *Lernaea cyprinacea* (Copepoda: Lernaeidae) in some freshwater fishes of the Kor River basin, southwest of Iran with some remarks on the ecological aspects of lernaeosis in the country. Iranian Journal of Fisheries Sciences, 15(1):369-389.
Sayyadzadeh, G. and Joladeh Roudbar, A. 2014. Occurrence of *Lernaea cyprinacea* (Crustacea: Copepoda) in an endemic cyprinid fish, *Chondrostoma orientale* Bianco & Banarescu, 1982 from the Kor River basin, southwestern Iran. Iranian Journal of Ichthyology 1(3):214-217.
Sayyari, H. and Rahmani, H. 2016. The study of population dynamics of *Capoeta damascina* (Valenciennes, 1842) in Roudbal River, Fars Province. Journal of Applied Ichthyological

Research, 4(1):1-15. In Farsi.
Sazgar, A., Safari, O., Danesh, S. and Yazdanimoghadam, F. 2017. Characterization of chahu's fish comparison (*Schizothoarx* (*sic*) *pelzami*) in the Kavir area and Tajan using truss and morphometric system. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Sazgar, A., Safari, O., Danesh, S. and Yazdani Moghaddam, F. 2019. Evaluation of morphological flexibility of khajoo fish (*Schizotorax* (*sic*) *pelzami* Kessler 1870) in eastern Iran using geometric morphometric method. Journal of Applied Biology, 32(3):104-114. In Farsi.
Scharlau, K. 1968. Geomorphology, pp. 186-194. In: Fisher, W. B. (Ed.). The Cambridge History of Iran. Volume 1. The Land of Iran. Cambridge University Press, Cambridge. xix + 784 pp.
Scheil, V. 1918. Sur le marché aux poissons de Larsa. Revue d'Assyriologie et d'Archéologie Orientale, 15(4):183-194.
Schiewer, U., Al-Saadi, H. A. and Hameed, H. A. 1982. On the diel rhythm of phytoplankton productivity in Shatt al-Arab at Basrah, Iraq. Archiv für Hydrobiologie, 93(2):158-172.
Schofield, P. J., Williams, J. D., Nico, L. G., Fuller, P. and Thomas, M. R. 2005. Foreign Nonindigenous Carps and Minnows (Cyprinidae) in the United States - A Guide to their Identification, Distribution, and Biology. U. S. Geological Survey Scientific Investigations Report, 2005-5041:vi + 104 pp.
Schönhuth, S., Vukic, J., Sanda, R., Yang, L. and Mayden, R. L. 2018. Phylogenetic relationships and classification of the Holarctic family Leuciscidae (Cypriniformes: Cyprinoidei). Molecular Phylogenetics and Evolution, 127:781-799.
Schöter, C., Özuluğ, M. and Freyhof, J. 2009. *Capoeta caelestis*, a new species from Göksu River, Turkey (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 20(3):229-236.
Schultz, L. P. 1957. The generic names Barbus and Puntius. Tropical Fish Hobbyist, 5(4):14-15, 29-31.
Schüz, E. 1959. Die Vogelwelt des Südkaspischen Tieflandes. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. 199 pp.
Schweizer, G. 1975. Untersuchungen zur Physiogeographie von Ostanatolien und Nordwestiran. Geomorphologische, klima- und hydrogeographische Studien im Vansee- und Rezaiyehsee-Gebiet. Tübinger Geographische Studien, 60(9):VIII + 145 pp., 21 Karten, 12 Fotos.
Scott, D. A. 1993. Wetlands of West Asia - A regional overview, pp. 9-22. In: Moser, M. and van Vessem, J. (Eds.). Wetland and Waterfowl Conservation in South and West Asia. Proceedings of the International Symposium, Karachi, Pakistan 14-20 December 1991, International Waterfowl and Wetlands Research Bureau (IWRB) Special Publication, Slimbridge, 25, Asian Wetland Bureau (AWB) Publication, Kuala Lumpur, 85.
Scott, D. A. 1995 (Ed.). A Directory of Wetlands in the Middle East. IUCN, Gland, Switzerland and International Waterfowl and Wetlands Research Bureau, Slimbridge, U.K. xvii + 560 pp.
Scott, D. A., Hamadani, H. M. and Mirhosseyni, A. A. 1975. The Birds of Iran. Department of the Environment, Tehran. 410 pp.
Seçer, B., Çiçek, E. and Celepoğlu, Y. 2020. *Alburnus caeruleus* (Heckel, 1843) türünün Bazı Populasyon Dinamiği Parametreleri, Merzimen Çayı, Fırat Havzası, Türkiye

[Determination of some population parameters of *Alburnus caeruleus* (Heckel, 1843) from Merzimen Stream, Euphrates Basin, Turkey]. KSÜ Tarım ve Doğa Derg, 23(5):1240-1244.

Sedaghat, S., Ahangari, W. D. P., Arabi, M. H., Rahmani, H. and Vatandoost, S. 2012. Age and growth of chub, *Squalius cephalus* (Bonaparte, 1837), in Gamasiab River of the Hamadan Province, Iran. World Journal of Fish and Marine Sciences, 4(6):550-553.

Sedaghat, S. and Hoseini, S. A. 2012a. Age and growth of Caspian roach, *Rutilus rutilus caspicus* (Jakowlew, 1870) in southern Caspian Sea, Iran. World Journal of Fish and Marine Sciences, 4(5):533-535.

Sedaghat, S. and Hoseini, S. A. 2012b. Length-weight and length-length relationships of *Cyprinion macrostomus*, (Heckel, 1843) in Dalaki River Bushehr, in south of Iran. World Journal of Fish and Marine Sciences, 4(5):536-538.

Sedaghat, S. and Hoseini, S. A. 2012c. Variations in water quality parameters of Ala-Gol Wetland in Golestan Province, Iran. Middle-East Journal of Scientific Research, 12(3):402-405.

Sedaghat, S., Hoseini, S. A., Larijani, M. and Ranjbar, K. S. 2013. Age and growth of common carp (*Cyprinus carpio* Linnaeus, 1758) in Southern Caspian Sea, Iran. World Journal of Fish and Marine Sciences, 5(1):71-73.

Sedaghat, S., Vatandoust, S. and Nowferesti, H. 2013. Length-weight and length-length relationships of *Capoeta capoeta intermedia* (Osteichthyes: Cyprinidae) in Dalaki River Bushehr, south of Iran. World Journal of Fish and Marine Sciences, 5(3):271-274.

Sedaqat-kish, J. 2000. Marriage with a qanat in Iran. Barzegar, Tehran, 819:64. In Farsi (English translation at www.netiran.com/Htdocs/Clippings/Social/200629XXSO01.html, downloaded 15 December 2000).

Sedigh Eteghad, S., Ghavami, S., Mortezavi, J. and Mirzaei, H. 2008. Comparative survey on anesthetizing effects of medicinal herbs *Valerian officinalis*, *Melissa officinalis*, *Papaver somniferum*, and *Papaver bracteatum* on gold fish (*Carassius auratus*). Iranian Scientific Fisheries Journal, 17(1):91-98. In Farsi.

Sedighi, S., Sajjadi, M. and Hoseinifar, S. M. 2019. The effects of dietary malic acid on growth performance and intestinal histomorphology in goldfish (*Carassius auratus*). Journal of Animal Environment, 11(3):147-154. In Farsi.

Sedighkia, M., Abdoli, A. and Datta, B. 2021. Optimizing monthly ecological flow regime by a coupled fuzzy physical habitat simulation-genetic algorithm. Environment Systems and Decisions, doi:10.1007/s10669-021-09809-z.

Segherloo, I. H., Ghaedrahmati, N. and Freyhof, J. 2016. *Eidinemacheilus*, a new generic name for *Noemacheilus smithi* Greenwood (Teleostei; Nemacheilidae). Zootaxa 4147(4):466-476.

Seidgar, M. 2016. Comparative study of goldfish growth and survival rate feeding by fairy shrimp (*Phallocryptus spinosa*), *Artemia* and concentrate diet. Iranian Fisheries Science Research Institute, Tehran. 48 pp. In Farsi.

Seidgar, M., Hafezieh, M. and Nekuie Fard, A. 2015. The variation in the effect of fairy shrimp, *Phallocryptus spinosa*, artemia, *Artemia urmiana*, and concentrate diet on pigmentation and skin color quality of goldfish (*Carassius auratus*). Iranian Scientific Fisheries Journal, 24(1):13-25. In Farsi.

Seidgar, M., Mohebbi, F., Nekule Fard, A., Seyed Mortezaei, S. R., Dadgar, S., Alizadeh Osalou, Z. and Shiri, S. 2020. Investigating the effect of physico-chemical and water trophy (*sic*)

state on fish cage culture in the Aras Dam reservoir, West Azarbaijan. Journal of Animal Environment, 12(2):283-290. In Farsi.

Seiedi, J. and Kalbassi, M. R. 2017. Effects of different levels of diet nano selenium (nano-se) on growth and gonad quality indices and seminal plasma antioxidants in male goldfish (*Carassius auratus gibelio*). Aquatic Physiology and Biotechnology, 5(2):67-71. In Farsi.

Seiedzadeh, S. M., Yavari, V., Azarm, H. M. and Mosavi, M. 2015. Evaluation effect of dietary egg lecithin on digestive enzymes and body composition of juvenile binni (*Mesopotamichthys sharpeyi* Gunther, 1874). International Journal of Aquatic Biology, 3(2):72-77.

Seiedzadeh, S. M., Yavari, V., Mohammadiazarm, H. and Mousavi, M. 2016. Lecithin effects on blood biochemical parameters and resistance to thermal stress in juvenile of *Mesopotamichthys sharpeyi* (Cyprinidae family). Iranian Journal of Fisheries Sciences, 15(4):1455-1464.

Seifabadi J., Khodabandeh, S., Esmaili Sari, A. and Abtahi B. 2001. Some biological features of Caspian Sea ctenophores. The Second International Iran and Russia Conference (Agriculture and Natural Resources), Moscow, Abstract, pp. 171-172.

Seifali, M. 2012. Population biology of *Alburnoides* Jeitteles 1861 (Actinopterygii: Cyprinidae) in Iran. Ph.D. Thesis, Universiti Putra Malaysia, Serdang. xv + 183 pp.

Seifali, M., Arshad, A., Esmaeili, H. R., Kiabi, B. H., Yazdani Moghaddam, F. and Fardad, N. 2012. Fecundity and maturation of south Caspian spirlin, *Alburnoides* sp. (Actinopterygii: Cyprinidae) from Iran. Iranian Journal of Science and Technology, 36(A2):181-187.

Seifali, M., Arshad, A., Moghaddam, F. Y., Esmaeili, H. R., Kiabi, B. H., Daud, S. K. and Aliabadian, M. 2012. Mitochondrial genetic differentiation of spirlin (Actinopterigii (*sic*): Cyprinidae) in the south Caspian Sea basin of Iran. Evolutionary Bioinformatics, 2012(8):219-227.

Seifali, M., Arshad, A., Nurul Amin, S. M., Hasanzadeh Kiabi, B., Esmaeili, H. R. and Moghaddam, F. Y. 2012. Population dynamics of Caspian spirlin (Actinopterygii: Cyprinidae) in the Kessleian Stream, Iran. African Journal of Biotechnology, 11(38):9214-9222.

Seifali, M., Yazdani Moghaddam, F., Aliabadian, M. and Esmaeili, H. R. 2012. Mitochondrial genetic and truss network differentiation of spirlin (Actinopterygii: Cyprinidae) In South Caspian Sea Basin of Iran. XIV European Congress of Ichthyology, Liège, Belgium, 3-8 July 2012 (poster).

Seifi, A., Eagderi, S. and Khorasani, N. A. 2017. Descriptive skeletal structure of *Capoeta buhsei* Kessler, 1877 from Namak Lake basin. Journal of Animal Environment, 9(1):201-208. In Farsi.

Seifi, H. 1990. The investigation of aquatic fauna in Talar River. B.Sc. Thesis, Agricultural Sciences and Natural Resources University, Gorgan. 64 pp. In Farsi.

Seifi, H., Rahmani, H. and Janikhalili, K. 2017a. Length-weight relationship and condition factor in *Squalius turcicus* in Shahid Rajai Dam in Sari. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 320-324. In Farsi.

Seifi, H., Rahmani, H. and Janikhalili, K. 2017b. Compare of back-calculation methods of *Squalius turcicus* in Shahid Rajai Dam in Sari. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 325-329. In

Farsi.
Seifi, T., Imanpoor, M. R., Jafari, V. and Makhdomi, C. 2011. The injection effects of ovaprim, HCG and pituitary extract hormone on sperm quality in cultured common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 64(1):55-62. In Farsi.
Seifi, T., Imanpoor, M. R. and Makhdomi, Ch. 2015. The investigation of semen spermatological and biochemical parameters in wild and cultured common carp (*Cyprinus carpio* Linnaeus, 1758). Journal of Animal Researches (Iranian Journal of Biology), 27(4):535-542. In Farsi.
Seifi, T., Imanpour, M. R. and Valiollah, J. 2010. The effects of ovaprim, HCG and pituitary extract injections on biochemical parameters of seminal plasma in cultured common carp (*Cyprinus carpio* L.). Journal of Science, Kharazmi University, 10(3):923-930.
Seifi, T., Imanpur, M. R. and Makhdomi, Ch. 2012. The effects of semen ion ratios on spermatological parameters in carp (*Cyprinus carpio*). Journal of Science, Kharazmi University, 11(4):241-250.
Seifzadeh, M. 2020. Correlation of chromium, zinc and copper with length, weight, age and gender in muscle of white fish (*Rutilus kutum*) captured from northern and southern Anzali wetlands. Journal of Wetland Ecobiology, 12(44):5-18. In Farsi.
Seifzadeh, M., Valipour, A. and Khanipour, A. A. 2018. Study of fluorene phenanthrene and anthracene petroleum hydrocarbons in economic fish wetland Anzali. Journal of Food Hygiene, 8(3):37-48. In Farsi.
Seifzadeh, M., Valipour, A., Zareh Gashti, Gh. And Khanpour, A. A. 2018. Study on bioaccumulation of aldrin, diazinon and endrin pesticides in the edible muscle tissues of commercially important fish species of the Anzali Wetland. Iranian Scientific Fisheries Journal, 27(3):23-30. In Farsi.
Seighali, H. 1973. Helminth parasites of carp in Iran. Doctor of Veterinary Medicine Thesis, University of Tehran. 64 pp.
Semsar Yazdi, A. A. and Labbaf Khaneiki, M. 2010. Veins of Desert: A Review on the Technique of Qanat/Falaj/Karez. Iran Water Resources Management Organization, Tehran. 310 pp.
Şen, D., Aydin, R. and Çalta, M. 2001. Relationships between fish length and otolith length in the population of *Capoeta capoeta umbla* (Heckel, 1843) inhabiting Hazar Lake, Elazig, Turkey. Archives of Polish Fisheries, 9(2):267-272.
Şen, D., Aydin, R. and Çalta, M. 2002. Back-calculation of fork lengths of *Capoeta capoeta umbla* (Pisces: Cyprinidae) from otolith lengths. Pakistan Journal of Biological Sciences, 5(4):506-508.
Şen, D., Duman, E. and Ayvaz, Y. 1992. Age determination and length-weight relationship of *Bertinius subquincunciatus* (Günther,1868) in Keban Dam Lake. Ege Üniversitesi Su Ürünleri Yüksekokulu Su Ürünleri Dergisi, 9(33-36):203-210.
Šengör, A. M. C. 1984. The Cimmeride Orogenic System and the Tectonics of Eurasia. Special Paper of the Geological Society of America, 195:ix + 82 pp., map.
Sepehrfar, D., Hoseinifar, S. H. and Jafarnodeh, A. 2019. The effects of singular or combined administration of *Pediococcus acidilactici* and raffinos on mucosal immune parameters and intestinal histomorphology of gold fish (*Carassius auratus*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 12(1):25-34. In Farsi.

Sepehrfar, D., Hoseinifar, S. H. and Jafarnodeh, A. 2020. The effects of singular or combined administration of *Pediococcus acidilactici* and raffinos on growth performance and some biological characteristics of eggs and spermatogonal parameters in gold fish (*Carassius auratus*). Journal of Aquaculture Development, 13(4):69-79. In Farsi.

Sepehrfar, D., Sarvi Moghanlou, K., Hoseinifar, S. H. and Kolangi Miandare, H. 2018. Effect of singular and combined administration of *Pediococcus acidilactici* and *Agaricus bisporus* on some blood indices and non-specific immune parameters of common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 26(5):61-70. In Farsi.

Sepidnameh, M., Mohiseni, M., Bagheri, D., Banaee, M. and Nematdust Haghi, B. 2017. Comparative influence of oral administration of Shirazi thyme and vitamin E on health and growth in common carp juveniles exposed to cadmium. Journal of Animal Environment, 9(1):275-284. In Farsi.

Serdar, O. and Özcan, E. İ. 2018. Length-weight, length-length relationships and condition factor of *Chondrostoma regium* (Heckel, 1843) and *Barbus lacerta*, Heckel, 1843 from Karasu River (East Anatolia, Turkey). Turkish Journal of Agriculture - Food Science and Technology, 6(6):729-732.

Seyed Mortezaei, S. R. 2014. Development and evaluation of the polymerase chain reaction (PCR) method for diagnosis of spring viremia of carp virus (SVCV). Ph.D. Thesis, Shahid Chamran University of Ahvaz. 185 pp. In Farsi.

Seyed Mortezaei, S. R., Akhlaghi, M. and Abbasi, S. 2002. Comparison of different methods of in vitro culture and maintenance of *Ichthyophthirius multifilis*, the cause of white spot disease in fish. Iranian Journal of Veterinary Research, Shiraz University, 3(1):65-72.

Seyed Mortezaei, S. R., Mobedi, I. and Farahnak, A. 2000. Helminths of freshwater fishes in Khuzestan Province. Iranian Scientific Fisheries Journal, 9(1):35-38. In Farsi.

Seyed Mortezaei, S. R., Pazooki, J. and Masoumian, M. 2008. Nematodes from fresh water fishes of Khouzestan Province. Pajouhesh va Sazandegi, 77(4):2-10. In Farsi.

Seyed Mortezaei, S. R., Pazooki, J., Masoumian, M. and Kor, N. M. 2008. Identification of Myxozoa and Protozoa parasites of barboid fishes of water resources in Khouzestan Province. Iranian Scientific Fisheries Journal, 17(1):63-78. In Farsi.

Seyed-Emami, K. and Ashayeri, S. 2016. National Parks in Iran and the evolution of people-park relationships. Iranian Studies, 49(6):1079-1097.

Seyfabadi, J., Negarestan, H. and Naeech, N. 2005. Investigation on food competition between mullets (*Liza spp*) and kutum roach (*Rutilus frisii kutum*) along Mazandaran coast of the Caspian Sea. The Fourth International Iran and Russia Conference ‘Agriculture and Natural Resources’, September 8-10, Shahr-e Kord, Iran (abstract).

Seyfabadi, S. J., Matinfar, A. and Khodadoost, D. 2006. Effect of L-carnitine on growth and body protein and fat content of common carp. Journal of Marine Science and Technological Research, 1(1):21-27. In Farsi.

Seyfabadi, S. J., Oraji, H. and Nazari, R. M. 2002. Effect of L-carnitine on growth of kutum roach fry (*Rutilus frisii kutum*). Iranian Journal of Marine Sciences, 1(4):77-84, 139. In Farsi.

Seyfi, H., Rahmani, H. and Janikhalili, K. 2021. Population dynamics of *Squalius cephalus* in Shahid Rajai Dam in Sari, Mazandaran. Journal of Applied Ichthyological Research, 8(3):39-51. In Farsi.

Shaabanpur, B., Shaabani, A., Khodanazari, A. and Pakravanfar, S. 2010. Changes in chemical content and yield of carp farming *Cyprinus carpio* under different methods of salting.

Iranian Journal of Food Science and Technology, 6(4):69-76. In Farsi.
Shabani, A. and Askari, Gh. 2013. Microsatellite loci to determine population structure of *Garra rufa* (Heckel, 1843) in the Khuzestan Province (Iran). International Journal of Aquatic Biology, 1(4):188-194.
Shabani, A., Askari, G. and Moradi, A. 2013. Genetic variation of *Garra rufa* fish in Kermanshah and Bushehr provinces, Iran, using SSR microsatellite markers. Molecular Biology Research Communications, 2(3):81-88.
Shabani, N. and Darvish Bastami, K. 2010. Study ionic and non ionic factors of blood in kutum (*Rutilus frisii kutum*) emigrant to Tajan River. Journal of Animal Environment, 2(1)(5):31-36. In Farsi.
Shabanipour, N. and Abbasi, M. 2020. Ontogeny of the eye of Caspian kutum (*Rutilus frisii kutum*) from prehatch to final larval stage. Journal of Applied Ichthyological Research, 8(2):35-42. In Farsi.
Shabanipour, N. and Haghi, N. 2019. Comparative retina stratification in embryos, larvae and adults of *Alburnus chalcoides*. Journal of Applied Ichthyological Research, 7(1):1-16. In Farsi.
Shabanpour, B., Asgharzadeh Kani, A., Hosseini, H. and Abbasi, M. 2008. Lipid quality changes of silver carp (*Hypophthalmichthys molitrix*) during frozen storage. Journal of Agricultural Sciences and Natural Resources, 15(1):38-43. In Farsi.
Shabanpour, B. and Ebrahimi, M. H. 2011. Comparison between chemical composition and sensory evaluation parameters of giant gourami (*Osphronemus goramy*), rainbow trout (*Oncorhynchus mykiss*) and common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 64(3):201-216. In Farsi.
Shabanpour, B. and Etemadian, Y. 2016a. The shelf-life of conventional surimi and recovery of functional proteins from silver carp (*Hypophthalmichthys molitrix*) muscle by an acid or alkaline solubilization process during frozen storage. Iranian Journal of Fisheries Sciences, 15(1):281-300.
Shabanpour, B. and Etemadian, Y. 2016b. Chemical changes and shelf-life of conventional surimi and proteins recovered using pH change method from common carp (*Cyprinus carpio*) muscle during 5 months storage at -18ºC. Iranian Journal of Fisheries Sciences, 15(1):311-332.
Shabanpour, B., Etemadian, Y. and Alami, M. 2016. Comparative study on some biochemical characteristics of surimi from common carp and silver carp and proteins recovered using an acid-alkaline process. Iranian Journal of Fisheries Sciences, 14(3):583-597.
Shabanpour, B., Kashiri, H., Moloudi, Z. and Hoseininezhad, A. S. 2007. Effects of washing bouts and times on surimi quality prepared from common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 16(1):81-92. In Farsi.
Shabanpour, B., Kordjazi, M. and Kamari, S. 2016. Determination of silver carp (*Hypophthalmichthys molitrix*) cracker formulation and its quality changes during three months storage at room temperature. Journal of Fisheries (Iranian Journal of Natural Resources), 68(4):589-602. In Farsi.
Shabanpour, B., Rahmanifarah, K. and Shabani, A. 2011. Effects of crowding and two slaughtering procedures on blood physiology and some muscle physiochemical factors in common carp. Scientific-Research Iranian Veterinary Journal, 6(4)(29):(abstract).
Shabanpour, B., Rahmanifarah, K. and Shabani, A. 2012. Evaluation of post mortem flesh quality attributes in common carp (*Cyprinus carpio* L.) slaughtered by exsanguination

and hypothermia methods. Iranian Journal of Food Science and Technology, 9(36):21-31. In Farsi.

Shabanpur, B., Shabani, A., Khodanazary, A. and Pakravanfar, S. 2010. Effect of salt concentration in salting process on the changes biochemical characteristics and yield silver carp *Hypophthalmichthys molitrix* fillet. Journal of Marine Sciences and Technology, 8(3-4):15-23. In Farsi.

Shabanpur, B., Shabani, A. and Pourashouri, P. 2008. The comparison of quality changes in frozen whole and gutted silver carp (*Hypophthalmichthys molitrix*) and determination of their shelf life during storage at -18°C. Pajouhesh va Sazandegi, 21(3)(80):103-107. In Farsi.

Shadi, A., Dehghan Mediseh, S., Kouchanian, P. and Gandomi, Y. 2011. Length-weight relationships for 6 fish species from Khuzestan (north of Persian Gulf), Iran. World Journal of Fish and Marine Sciences, 3(2):129-131.

Shafee, Z., Dorafshan, S. and Keivany, Y. 2012. Use of primers developed for cyprinids in survey of genetic structure of Alburnus mossulensis Heckel, 1843. The First Conference of DNA Barcoding and Taxonomy, Mashhad, Iran. (title).

Shafee, Z., Dorafshan, S., Keivany, Y. and Qasemi, S. A. 2013. Genetic structure of Mosul bleak (*Alburnus mossulensis* Heckel, 1843) using microsatellite marker in Tigris basin. Journal of Taxonomy and Biosystematics, 5(17):9-22, 2. In Farsi.

Shafei, M. 2002. Distribution and importance of fish Acanthocephalans in 15 Khordad Dam Lake. Honours Dissertation, Isfahan University of Technology, Isfahan. 79 pp.

Shafi, M. and Jasim, B. M. 1982. Some aspects of the biology of a cyprinid, *Aspius vorax* Heckel. Journal of Fish Biology, 20(3):271-278.

Shafi, M., Shalli, M. R. and Saeed, B. M. 1981. Capoeta pestai (Pietschmann) (Cyprinidae) a new record for Iraqi waters. Bulletin of the Natural History Research Centre, Baghdad, 7(4):(1980):173-175.

Shafiei, F. 2016. Effect of alcoholic extract of pomegranate peel (*Punica granatum* L.) on blood parameters of common carp (*Cyprinus carpio*) fingerling. Journal of Fisheries Science and Technology, 5(2):63-76. In Farsi.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2008. The comparative study of some ionic blood indices of female kutum broodstock (*Rutilus frisii kutum*). Journal of Biology Science, 2(3)(series no. 6):51-61. In Farsi.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2009a. The trend of ovarian development and some gonadal indices in kutum (*Rutilus frisii kutum* Kamenskii, 1901) from Bandar-e Kiyashahr southwestern of Caspian Sea. Journal of Biology Science, 2(4)(series no. 7):37-48. In Farsi.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2009b. Study on sexual maturity and levels of gonad steroid hormones in female kutum *Rutilus frisii kutum* (Kamenskii, 1901) during spawning season from river Sefid-Rood of the southern Caspian Sea. Journal of Cell and Animal Biology, 3(11):208-215.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2010a. Study on levels of 17-beta estradiol and testosterone in female kutum *Rutilus frisii kutum* (Kamenskii, 1901) of southern Caspian Sea. World Journal of Zoology, 5(3):217-224.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2010b. Histological study of ovarian development and sexual maturity of kutum (*Rutilus frisii kutum* Kamenskii, 1901). World Applied Sciences Journal, 8(11):1343-1350.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2011a. Study on levels of 17-beta estradiol and testosterone in female kutum *Rutilus frisii kutum* (Kamenskii, 1901) of southern Caspian Sea. World Journal of Zoology, 6(3):220-226.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2011b. Study on ovarian follicle ultra structure and rhythm of gonad development in (*Rutilus frisii kutum*) from Caspian Sea. World Applied Sciences Journal, 13(3):431-437.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2011c. Annual rhythm of gonad development trend and ovarian stages in Caspian Sea kutum (*Rutilus frisii kutum*). Journal of the Fisheries Society of Taiwan, 38(1):21-30.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2011d. Study on some blood ionic and metabolic indices in maturated and maturing female's kutum (*Rutilus frisii kutum*). Iranian Journal of Biology, 24(2):293-302. In Farsi.

Shafiei Sabet, S., Imanpour, M. R., Aminian Fatideh, B. and Gorgin, S. 2016. Variations in plasma sex steroid hormones of the wild Caspian cyprinid fish, kutum (*Rutilus frisii kutum*). Journal of Cell and Molecular Research, 8(1):25-34.

Shafighi, T. and Bahre Kazemi, M. 2018. Effect of dietary levels of inulin prebiotic on the growth performance, survival and body composition in grass carp (*Ctenopharingodon* (*sic*) *idella*) fry. Journal of Experimental Animal Biology, 7(2):23-32. In Farsi.

Shah, S. L. 2002. Behavioural abnormalities of *Cyprinion watsoni* on exposure to copper and zinc. Turkish Journal of Zoology, 26(1):137-140.

Shahamat, S., Alishahi, M., Banaee, M. and Shariali, A. 2015. Effects of sub-lethal concentrations of atrazine on some oxidative stress biomarker in various tissues of grass carp (*Ctenopharyngodon idella*). Journal of Environmental Treatment Techniques, 3(1):1-6.

Shahbazi, S., Mirvaghefi, A., Abedi, A. and Taherian, M. 2015. Effect of temperature lethal concentration (LC_{50} 96-h) of cypermethrin on the Caspian kutum fish *Rutilus frisii kutum* (Kamensky, 1901). Journal of Fisheries (Iranian Journal of Natural Resources), 68(3):421-435. In Farsi.

Shahbazi, S., Mirvaghefi, A., Khalili, M., Abedi, M. and Ghafari, H. 2014. Determination of lethal concentration (LC_{50}) values of ediphenphos on goldfish (*Carassius auratus*), The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Shahbazi, S., Moëzzi, F., Poorbagher, H. and Rostamian, N. 2015. Effects of malathion acute toxicity on behavioral and haematological parameters in Capoeta damascina (Cypriniformes: Cyprinidae). Journal of Chemical Health Risks, 5(3):209-220.

Shahbazi, S., Poorbagher, H., Ghafari Farsani, H., Khazaei, A. and Chaharde Baladehi, E. 2014. The effect of different levels of malathion (malathion) on lethal concentrations (LC_{50} 96 h), hematocrit and clinical signs of white fish (*Rutilus frisii kutum*). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Shahbazi Naserabad, S., Mirvaghefi, A., Gerami, M. H. and Ghafari Farsani, H. 2015. Acute toxicity and behavioral changes of the gold fish (*Carassius auratus*) exposed to malathion and hinsosan. Iranian Journal of Toxicology, 8(27):1203-1208.

Shahi, M., Kamrani, E., Salehi, M., Habibi, R. and Hanafi-Bojd, A. A. 2015. Native larvivorous fish in an endemic malarious area of southern Iran, a biological alternative factor for chemical larvicides in malaria control program. Iranian Journal of Public Health,

44(11):1544-1549.
Shahifar, R., Patimar, R., Fazli, H., Raeisi, H., Gholizadeh, M. and Jafaryan, H. 2020. Growth and mortality parameters of Caspian kutum, *Rutilus kutum*, in southern Caspian Sea. International Journal of Aquatic Biology, 8(1):56-65.
Shahkar, E., Khara, H. and Soudagar, M. 2008. The effect of feeding frequency on the growth and survival white fish larval in Caspian Sea (*Rutilus frisii kutum*, Kamensky 1901). Journal of Biology Science, 2(3)(series no. 6):41-49. In Farsi.
Shahkar, E., Khara, H. and Soudagar, M. 2009. An investigation about culture tank colour effect on growth and survival rate of kutum larvae Caspian Sea (*Rutilus frisii kutum*, Kamensky 1901). Journal of Biology Science, 3(2)(series no. 9):37-45. In Farsi.
Shahkar, E., Khara, H., Soudagar, M. and Azimi, A. 2011. The effect of high protein and feeding frequency on the growth and survival kutum larvae in Caspian Sea (*Rutilus frisii kutum*, Kamensky 1901). Journal of Marine Science and Technology Research, 5(4):69-79. In Farsi.
Shahkar, E., Khara, H. and Sudagar, M. 2011. Effects of increase diet protein on feeding frequency and growth and survival of Caspian kutum (*Rutilus frisii kutum*, Kamensky 1901). Journal of Fisheries, 5(1):107-116. In Farsi.
Shahkar, E., Kim, D., Mohseni, M., Khara, H., Yun, H. and Bai, S. C. 2015. Effects of photoperiod manipulation on growth performance and hematological responses of juvenile Caspian roach *Rutilus rutilus caspicus*. Fisheries and Aquatic Sciences, 18(1):51-56.
Shahkar, E., Shahkar, A. and Dadrass, H. 2011. Effects of replacement of fish meal with plant protein sources (soybean meal and corn gluten) on growth and carcass composition of *Rutilus frisii kutum* fingerlings. Animal Nutrition and Feed Technology, 11(2):257-264.
Shahlapour, S., Afraei Bandpei, M. A., Rabbaniha, M., Pourang, N. and Nasrollahzadeh, H. 2019. Diversity and distribution of larval and juvenile fish in nearshore waters of the southeastern Caspian Sea and Gorgan Bay. Iranian Journal of Fisheries Sciences, 18(2):332-348.
Shahmohammadi, H. R., Bakar, J., Russly, A. R., Noranizan, M. A. and Mirhosseini, H. 2014. Puffed corn-fish snack development by extrusion technology. Iranian Journal of Fisheries Sciences, 13(3):748-760.
Shahnazari, D., Mousavi-Sabet, H., Vatandoust, S., Subba, S. 2020. Study on frequency, distribution and biodiversity of estuarine and freshwater fishes in Shalmanrud River (the southwestern Caspian Sea basin - Guilan Province). Journal of Marine Biology, 12(3):79-92. In Farsi.
Shahni Danesh, A., Sadegh Ahadi, M., Fahmi, H., Habibi Nokhandan, M. and Eshraghi, H. 2016. Climate change impact assessment on water resources in Iran: applying dynamic and statistical downscaling methods. Journal of Water and Climate Change, 7(3):551-577.
Shahradnia, H., Chamani, A. and Zamanpoore, M. 2020. Evaluateation (*sic*) of water quality of Ghareh-Aghaj River (Fars province, Iran). Journal of Applied Biology, 33(3):99-110. In Farsi.
Shahriari Moghadam, M., Abtahi, B., Rezaei, S. and Rahdari, A. 2014. Early ontogenetic development of digestive system in *Schizothorax zarudnyi* Nikolskii, 1897 (Actinopterygii: Cyprinidae) larvae. Italian Journal of Zoology, 81(2):194-203.
Shahriari Moghadam, M., Ahmadifar, E., Sheikh Asadi, M., Ebrahimi Jorjani, H. and Fadaei, R. 2018. Effects of salinity on mortality, growth performance, blood traits and gill

histopathology of snowtrout, *Schizothorax zarudnyi*. Journal of Applied Ichthyological Research, 6(2):103-118. In Farsi.

Shahriari Nia, E., Asadollahfardi, G. and Heidarzadeh, N. 2016. Study of the environmental flow of rivers, a case study, Kashkan River, Iran. Journal of Water Supply: Research and Technology-Aqua, 65(2):181-194.

Shahryari, H., Mahboobi Soofiani, N., Paykan Heyrati, F. and Melakpouri, P. 2019. Effect of water-borne genistein as a natural source of phenolic compounds on hematological parameters of common carp (*Cyprinus carpio*). Journal of Aquaculture Sciences, 7(1):1-8. In Farsi.

Shahsavani, D., Baghshani, H., Reza Aslani, M. and Sadat Fatemi, F. 2012. The impact of allicin on lead-induced oxidative damage in selected organs of the common carp (*Cyprinus carpio*). Comparative Clinical Pathology, 21(5):769-775.

Shahsavani, D., Farhoudi, M. Movasaghi, A. R. and Keykha, F. 2007. Clinical and pathological study of effects of phenytoin sodium in gill, liver and kidney of goldfish (*Carassius auratus*). Pajouhesh va Sazandegi, 19(1)(74):150-155. In Farsi.

Shahsavani, D., Mohri, M. and Nazeri, K. 2004. A study of anionic detergent (shampoo) on blood parameters of goldfish (*Carassius auratus*). Pajouhesh va Sazandegi, 16(4)(61):99-103. In Farsi.

Shahsavani, D., Mohry, M. and Bijarchi, A. 2005. Effects of anionic detergent (labs) on serum biochemical parameters in *Carassius auratus*. Iranian Scientific Fisheries Journal, 14(2):51-58. In Farsi.

Shahsavani, D., Movasaghi, A. R. and Faraji S. H. 2003. Clinical and histopathological study of experimental kerosene poisoning in goldfish (*Carassius auratus*). Pajouhesh va Sazandegi, 16(1)(58):8-11. In Farsi.

Shahsavani, D., Movasaghi, A. R., Ghodrati, H. and Sahebi, Gh. H. 2001. Comparative study of the healing effects of zinc oxide and phenytoin sodium on cutaneous lesions of goldfish (*Carassius auratus*). Pajouhesh va Sazandegi, 14(3)(52):98-102. In Farsi.

Shahsavani, D., Movasaghi, A. R. and Omidzahir, Sh. 2009. Protective effect of thiamine on the induced lesions by experimental lead poisoning in gold fish (*Carassius auratus*). Journal of Veterinary Research, 64(3):237-242. In Farsi.

Shahsavani, D., Movasaghi, A. R. and Sahebi, Gh. H. 2002. Comparative histological survey of the healing effects of two drugs vitamin A and phenytion sodium ointment on the gold fish (*Carassius auratus*) cutaneous lesion. Journal of Veterinary Research, 57(1):43-46. In Farsi.

Shahsavani, D. and Movassaghi, A. 2003. Study on hepatic and renal pathology induced by anionic detergent in goldfish (*Carassius auratus*). Pajouhesh va Sazandegi, 16(2)(59):100-103. In Farsi.

Shahsavani, D., Movassaghi, A. and Sahebi, G. H. 2002. Survey of the healing effects of three drugs phenytoin sodium, znic oxid (*sic*) and vitamin A ointment on the gold fish cutaneous lesions. Book of Abstracts 27th World Veterinary Congress, September 25-29, 2002, Tunis-Tunisia (abstract).

Shahsavani, D., Movassaghi, A. R. and Baghi, L. 2005. Studying clinical and histopathological effects of phenytoin sodium on cutaneous wounds in the goldfish (*Carassius auratus*). Iranian Scientific Fisheries Journal, 13(4):65-74. In Farsi.

Shahsavani, D., Movassaghi, A. R. and Maghsoudlou, A. 2003. Clinical and histopathological study of the effects of an anionic detergent on the gill of goldfish (*Carassius auratus*).

Journal of the Faculty of Veterinary Medicine, University of Tehran, 58(1):29-32. In Farsi.

Shaikh, S. A. and Hafeez, M. A. 1993. Effects of photoperiod and temperature on gonadal response in the cyprinid fish, *Cyprinion watsoni*. Pakistan Journal of Zoology, 25(3):233-241.

Shaikh, S. A. and Jalali, S. 1989. Seasonal variation in the testes of the fish, *Cyprinion watsoni*. Proceedings of the Pakistan Congress of Zoology, 9:47-59.

Shaikh, S. A. and Jalali, S. 1991. Seasonal changes in the ovary of the cyprinid fish *Cyprinion watsoni*. Pakistan Journal of Zoology, 23(1):19-25.

Shajie, H. 2003. Study biological characteristics related with development and reproduction in *Barbus capito* on the southern coast of the Caspian Sea, Gilan Province. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 144 pp. In Farsi.

Shajiee, H., Fazli, H. and Bani, N. 2009. Biological study of reproduction in (*Capoeta capoeta gracilis*) in south coasts of Caspian Sea Mazandaran Province (Tajan River). Journal of Animal Biology, 1(2):31-35. In Farsi.

Shajiee, H., Vossughi, G. H., Oryan, S. and Ramin, M. 2002. Biological characteristics of growth and reproduction in *Barbus capito* in south coasts of the Caspian Sea - Gilan Province. Iranian Journal of Marine Sciences, 1(4):85-98, 138. In Farsi.

Shakeri, A., Shakeri, R. and Mehrabi, B. 2015. Potentially toxic elements and persistent organic pollutants in water and fish at Shahid Rajaei Dam, north of Iran. International Journal of Environmental Science and Technology, 12(7):2201-2212.

Shakeri, A., Sharifi Fard, M., Mehrabi, B. and Rastegari Mehr, M. 2020. Occurrence, origin and health risk of arsenic and potentially toxic elements (PTEs) in sediments and fish tissues from the geothermal area of the Khiav River, Ardebil Province (NW Iran). Journal of Geochemical Exploration, 208:106347.

Shakiba, M. 2015. Effects of pollution and development on biodiversity of fishes in Lesser Zab. M.Sc. Thesis, Shahid Rajaee Teacher Training University, Piranshahr, West Azarbayjan. 120 pp. In Farsi.

Shakirova, F. M. and Sukhanova, A. I. 1994. Iktiofauna Turkmenistana (sostav i rasprostranenie) [Ichthyofauna of Turkmenistan (composition and distribution)]. Izvestiya Akademii Nauk Turkmenistana, Seriya Biologicheskikh Nauk, 3(1993):35-45.

Shakoori, M., Afraei Bandpei, M. A., Farabi, M. V. and Rajabi, I. 2021. The investigation of abundance of microbenthic (*sic*, macrobenthos) as natural food in *Rutilus kutum* ponds of Shahid Rajaie Center (Mazandaran province, 2019). The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).

Shamekhi Ranjbar, K., Patimar, R., Ghorbani, R. and Azimi, A. 2012. Investigation of fecundity and its relationship with some growth indices of *Capoeta capoeta Gracilis* (*sic*) (Keyserling, 1861) in the two streams (Dough and Zarrin-gol) of Gorganroud River basin, Golestan Province, northern Iran. World Journal of Fish and Marine Sciences, 4(1):111-114.

Shamekhi Ranjbar, K., Patimar, R., Ghorbani, R., Azimi, A. and Sedaghat, S. 2013. The investigation growth models of *Capoeta capoeta Gracilis* (*sic*) (Keyserling, 1861) in 5 streams of Gorganrud River basin, northern Iran. World Journal of Zoology, 8(1):30-35.

Shamekhi Ranjbar, K., Patimar, R., Ghorbani, R. and Kordjazi, Z. 2012a. Back-calculate length-at-age estimates of *Capoeta capoeta gracilis* in Dough stream, south eastern Caspian Sea,

Iran. Journal of Research in Biology, 2(1):15-18.
Shamekhi Ranjbar, K., Patimar, R., Ghorbani, R. and Kordjazi, Z. 2012b. Comparison relative of abundance of *Capoeta capoeta gracilis* in five streams of Gorganroud River basin, Golestan Province, northern Iran. Journal of Research in Biology, 2(1):19-22.
Shamloofar, M. and Hajimoradlou, A. M. 2019. Determination of LC_{50} and some histopatological (*sic*) changes due to sevin in common carp "*Cyprinus carpio*" juveniles. New Technologies in Aquaculture Development (Journal of Fisheries), 13(3):1-10. In Farsi.
Shamloofar, M., Nousrat Pour, A. and Lakzaei, F. 2015. The effect of different levels of immunogen stimulant on growth and survival of common roach, *Rutilus rutilus caspicus*. New Technologies in Aquaculture Development (Journal of Fisheries), 9(1):11-16. In Farsi.
Shamloufar, M. and Haji Moradlou, A. A. 2008. Determination of LC_{50} and some histopathological changes due to sevin in common carp "Cyprinus carpio" juveniles. Journal of Fisheries, 2(3):27-34. In Farsi.
Shamloufar, M., Jorjani, S. and Ghelichi, A. 2015. Determination of LC_{50} and some histopathological changes due to sevin in kutum "Rutilus frisii kutum" juveniles. Journal of Aquaculture Development, 9(1):43-52. In Farsi.
Shamoushaki, M. M. N., Galogah, K. M. and Mazini, M. 2012. Optimization of feeding frequency in *Cyprinus carpio* (Linnaeus, 1758). World Journal of Fish and Marine Sciences, 4(5):443-448.
Shams, M. and Afsharzadeh, S. 2009. Study of seasonal variations in phytoplankton in Zayandeh Rud Dam Lake. Iranian Journal of Biology, 21(5):784-795. In Farsi.
Shamsaei Mehrjan, M. and Amini, Sh. 2011. Producing possibility of earth worm (*Eisenia foetida*) in warm water fish farms in order to apply in common carp feeding. New Technologies in Aquaculture Development (Journal of Fisheries), 5(3):109-116. In Farsi.
Shamsi, Sh. 1996a. A review on *Heterophys heterophys*, a parasite from fish to man. Aquatics, 69:55-56. In Farsi.
Shamsi, Sh. 1996b. Human parasitic diseases caused by fishes: *Dyctophyma renale*. Aquatics, 71:30-31. In Farsi.
Shamsi, Sh. 1997. Helminth parasites of native fishes in Gorganrud, Tajan, Tonekabon and Shiroud rivers. Project Report, Fisheries Research Organization, Tehran. 28 pp.
Shamsi, Sh., Dalimi, A. and Pourgholam, R. 1997. First record of *Pseudopentagramma symmetrica* from I. R. Iran. Proceedings of the First Iranian Congress of Zoology, Tehran University of Teacher Education, Tehran, Iran, 17-18 September 1997, p. 92.
Shamsi, Sh. and Jalali, B. 1997. First record of some freshwater fish parasites (monogeneans) in Iran. Third International Symposium of Monogenea, 25-30 August 1997, Mazaryc University, Brno, Czech Republic, Papers and Abstracts, p. 76.
Shamsi, Sh. and Jalali, B. 2001a. Monogenean parasites of Barbus fishes of Iran. Proceedings of the First National Symposium on *Barbus* Fishes of Iran. Khuzestan Fisheries Research Center, Ahwaz, Iran, 9-10 January 2001, p. 12.
Shamsi, Sh. and Jalali, B. 2001b. Monogenean parasites of the Caspian roach (*Rutilus frisii kutum*) in Iran. In: ISM 4: 4th International Symposium on Monogenea, Brisbane, Australia, 9-13 July 2001, p. 80 (abstract).
Shamsi, Sh. and Jalali, B. 2001c. Monogenean parasites of Caspian Frisian roach (*Rutilus frisii kutum*) in Sefid-Rood River and Caspian Sea. Iranian Journal of Fisheries Science,

3(2):19-24.
Shamsi, Sh. and Jalali, B. 2003. Occurrence of *Gyrodactylus* pp. (Monogenea: Gyrodactylidae) from Iranian freshwater fishes. 45th Annual Scientific Meeting of the Australian Society for Parasitology, 6-10 July 2003, Darwin (title).
Shamsi, Sh., Jalali, B. and Aghazadeh Meshgi, M. 2009. Infection with *Dactylogyrus* spp. among introduced cyprinid fishes and their geographical distribution in Iran. Iranian Journal of Veterinary Research, Shiraz University, 10(1)(26):70-74.
Shamsi, Sh. and Pourgholam, R. 2001. Study on helminths of fishes of Shiroud River. Proceedings of the First Iranian Congress of Health and Diseases, University of Ahwaz, Iran, 13-15 February 2001, p. 48.
Shamsi, Sh., Pourgholam, R. and Daleemi-e-Asl, A. 1997. Infection rate of the Shiroud River fishes with *Clinostomum complanatum*. Iranian Fisheries Scientific Journal, 6(2):53-62, 9. In Farsi.
Shank, C. C. 2007. The Wildlife Conservation Society Afghanistan Biodiversity Conservation Project Hazarajat Component - 2006 Annual Report. Wildlife Conservation Society. 34 pp. (http://pdf.usaid.gov/pdf_docs/PDACJ926.pdf).
Shapland, G. 1997. Rivers of Discord. International Water Disputes in the Middle East. St. Martin’s Press, New York. xi + 183 pp.
Shapoori, M. 2021. Assessment destructive effects of environmental construction of dam on the river. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Shapoori, M. and Gholami. M. 2005. Actual situation of bony fishes of south Caspian Sea coasts. Canadian Conference for Fisheries Research (CCFFR)/Conférence canadienne de la recherche sur les pêches (CCRP), 6-9 January/janvier 6-9 2005, Windsor, Ontario (abstract).
Shapouri, M., Oryan, S. and Esmaili Sari, A. 2009. The impact of copper on histopathological point of gonad, liver and muscle tissues of *Cyprinus carpio*. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 3(7):23-29. In Farsi.
Sharbaty, S. 2015. Modeling results assessment of confidence interval between pen culture fish farms in Gorgan Bay. Journal of Aquaculture Development, 9(1):53-66. In Farsi.
Sharbaty, S. 2016a. Review necessity of the Caspian Sea water level decreasing and effects on the Gorgan Bay situation and solutions for overcoming the rise in future years. Journal of Utilization and Cultivation of Aquatics, 5(1):83-105. In Farsi.
Sharbaty, S. 2016b. Three dimensional modeling results assessment of water renewal time in order to development of aquaculture in Gorgan Bay. Journal of Aquaculture Development, 10(3):105-118. In Farsi.
Sharbaty, S. 2018. Investigating the probable future of the Gorgan Bay after separation from the Caspian Sea from the perspective of ecological succession. Journal of Utilization and Cultivation of Aquatics, 6(4):41-53. In Farsi.
Sharbaty, S. 2019. Modeling the effects of water level decreases on the optimum distance of fish pens in Gorgan Bay. Iranian Scientific Fisheries Journal, 28(1):49-58. In Farsi.
Sharghi, A., Abdoli, A., Rahmani, H., Shahraki, M. and Nazari, H. 2011. Environmental effects of Shahid Rajai’s Dam on aquatic fauna. Journal of Oceanography, 2(5):21-27. In Farsi.
Shariati, F. 2001. Determination of lateral concentration of hynozine, phenol and 1-nephtol in fry of *Rutilus frisii kutum*, *Abramis brama* and *Cyprinus carpio*. M.Sc. Thesis, Islamic

Azad University, Tehran. 190 pp.
Shariati, F., Esmaeili Sari, A. and Piri, M. 2004. Toxicity and LC50 determination of phenol and 1-naphthol in Caspian kutum and bream fingerlings. Iranian Scientific Fisheries Journal, 12(4):57-68. In Farsi.
Shariati, F., Esmaili Sari, A. and Piri, M. 2005. Toxicity and LC50 of phenol and naphthol in *Abramis brama* and *Rutilus frisii kutum* fingerlings. The Fourth International Iran and Russia Conference ‘Agriculture and Natural Resources’, September 8-10, Shahr-e Kord, Iran (abstract).
Shariati, M-T. 2003. Function of libraries and printed materials in Iranian aquaculture information system. World Aquaculture 2003, 20-23 May, Salvador, Brazil (title).
Shariati, M. T. and Nikfetrat, E. 2005. The attitude of fishermen towards stock enhancement and influencing factors: A case study in Guilan Province of Iran. Iranian Journal of Fisheries Sciences, 5(1):85-104.
Shariatmadari, A., Abbaspour, M., Abedi, Z., Vafainejad, A. and Tabatabae Yazdi, R. 2015. Different investigations of environmental impacts of climatic fluctuations on Lake Urmia. World Essays Journal, 3(2):30-33.
Sharibi, R., Pour, F., Vahedasi, A., Maniat, M. and Gavriloaie, C. 2015. Effects of probiotic Bactocell on growth and survival parameters of benni fish (*Mesopotamichthys sharpeyi*) fingerlings. AACL Bioflux, 8(5):805-809.
Sharif Rohani, M. 1994. Survey on parasites and parasitic diseases in Sistan region. Proceedings of the 2nd Symposium of Iranian Veterinary Clinics, Tehran. p. 109. In Farsi.
Sharif Rohani, M. 1995. Study of fish parasites in Hamoon Lagoon. Scientific Report of Abzigostar Company, Tehran. 68 pp.
Sharifi, M. 2005. The pattern of Caspian Sea penetration into the Anzali Wetland, Iran. The Fourth International Iran and Russia Conference ‘Agriculture and Natural Resources’, September 8-10, Shahr-e Kord, Iran (abstract).
Sharifi, M. 2006. The pattern of Caspian Sea water penetration into Anzali Wetland: introduction of a salt wedge. Caspian Journal of Environmental Sciences, 4(1):77-81.
Sharifi, M., Negatkhah Manavi, P., Chakmehdouz Ghasemi, GF. and Behmanesh, Sh. 2016. Population genetic structure of Caspian roach (*Rutilus rutilus caspicus*) using DNA sequencing in south Caspian Sea and Aras Lake. Journal of Aquaculture Development, 10(4):63-73. In Farsi.
Sharifi, M., Rastegar-Pouyani, N., Akmali, V. and Assadian Narengi, S. 2008. On distribution and conservation status of *Neurergus kaiseri* (Caudata: Salamandridae). Russian Journal of Herpetology, 15(3):169-172.
Sharifi, M., Valinassab, T. and Taghavi, L. 2018. The determination of cadmium concentrations in Caspian kutum (*Rutilus kutum*) tissues and assessment of the food consumption risk in the southern coast of Caspian Sea. Journal of Animal Environment, 10(3):213-220. In Farsi.
Sharifi, P., Mesbah, F. and Shahriari, A. 2019. Effect of sexuality on lipid content in blood, liver and muscle in cultured *Barbus grypus*. Journal of Animal Environment, 11(2):289-294. In Farsi.
Sharifian, M. 2006. Determination of feeding benni (*Barbus sharpyie*) (*sic*) (first phase: whole body analysis and biological characteristics). Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Ahvaz. http://en.ifro.ir (abstract).

Sharifian, M. 2014. Proximate composition of banni (*Barbus sharpeyi*) harvested from Khozestan Province water bodies (Shadegan and Horolazim estuaries). Journal of Aquaculture Development, 8(3):65-76. In Farsi.
Sharifian, M. 2015. On the occurrence of parasite, *Lernaea cyprinacea* from common carp, *Cyprinus carpio* farmed in ponds and rice fields. Comparative Clinical Pathology, 24(6):1435-1438.
Sharifian, M. 2016a. Biological indices of different length groups of benni fishes (*Barbus sharpeyi*) from Khuzestan water resources. Journal of Animal Environment, 7(4):135-142. In Farsi.
Sharifian M. 2016b. The survey of investigation about *Mesopotamichthys sharpeyi* projects in development program in Iranian Fisheries Research. Iranian Fisheries Science Research Institute, Ministry of Jihad-e Agriculture, Tehran. 68 pp. In Farsi.
Sharifian, M., Khani, F., Khosravi, K., Khalili, M. and Hedayati, A. 2013. Sublethal effect of nanosilver on the structure of gill of Caspian roach (*Rutilus rutilus caspicus*) fingerlings. International Journal of Aquatic Biology, 1(2):55-60.
Sharifikia, M. 2013. Environmental challenges and drought hazard assessment of Hamoun Desert Lake in Sistan region, Iran, based on time series of satellite imagery. Natural Hazards, 65(1):201-217.
Sharifinasab, Z., Banaee, M., Moheiseni, M. and Noori, A. 2016. The protective role of vitamin C and chitosan against paraquat-induced oxidative stress in muscles of common carp (*Cyprinus carpio*). Croatian Journal of Fisheries, 74(4):149-158.
Sharifinasab, Z., Banaee, M., Moheiseni, M. and Noori, A. 2018. Protective effects of vitamin C and chitosan against changes in the biochemical parameters in gill cells of common carp (*Cyprinus carpio*) exposed to paraquat. Journal of Aquaculture Development, 12(1):23-34. In Farsi.
Sharifinasab, Z., Banaie, M., Nemat Dost Haghighi, B. and Nori, A. 2016. Protective effects of vitamin C on blood biochemical parameters in common carp (*Cyprinus carpio*) exposed to paraquat. Iranian Scientific Fisheries Journal, 25(3):181-198. In Farsi.
Sharifinia, M., Imanpour, N. J. and Bozorgi, M. A. 2012. Ecological assessment of the Tajan River using feeding groups of benthic macroinvertebrates and biotic indices. Iranian Journal of Applied Ecology, 1(1):80-95. In Farsi.
Sharifinia, M., Mahmoudifard, A., Imanpour Namin, J., Ramezanpour, Z. and Yap, C. K. 2016. Pollution evaluation in the Shahrood River: Do physico-chemical and macroinvertebrate-based indices indicate same responses to anthropogenic activities? Chemosphere, 159:584-594.
Sharifinia, M., Ramezanpour, Z., Imanpour, J., Mahmoudifard, A. and Rahmani, T. 2013. Water quality assessment of the Zarivar Lake using physico-chemical parameters and NSF-WQI indicator, Kurdistan Province-Iran. International Journal of Advanced Biological and Biomedical Research, 1(3):302-312.
Sharifpour, A., Soltani, M., Abdolhai, H. and Ghauomi, R. 2003. Study of anaesthetic effects of clove oil (*Eugenia caryophyllata*) in common carp (*Cyprinus carpio*) under various pH and temperature condition. Iranian Scientific Fisheries Journal, 11(4):59-74. In Farsi.
Sharifpour, H., Mazandarani, M. and Khosbavar Rostami, H. A. 2014. Study of parasites infestation in cyprinoids cultures of Golestan province. Journal of Utilization and Cultivation of Aquatics, 3(3):15-26. In Farsi.
Sharifpour, I. 2004. Experimental study on histology of circumstance of wound healing process

in common carp (*Cyprinus carpio*). Iranian Scientific Fisheries Journal, 13(2):91-116. In Farsi.

Sharifpour, I., Abtahi, B., Heidary Jamebozorgi, F., Seyfabadi, S. J. and Taghizadeh, R. Z. 2011. Experimental assessment of the histopathological effects of water soluble fraction of crude oil on gill tissue of juvenile *Rutilus frisii kutum*. Iranian Scientific Fisheries Journal, 20(1):89-100. In Farsi.

Sharifpour, I., Pourgholam, R., Soltani, M., Hassan, M. D., Akbari, S. and Nouri, A. 2006. Light and electron microscope studies of grass carp (*Ctenopharyngodon idella*) organs following exposure to various sublethal concentrations of diazinon. Iranian Journal of Fisheries Sciences, 5(2):111-136.

Sharifpour, I., Soltani, M. and Fathollahi, B. 2005. A study of endosulfan caused lethal effects as well as histopathological changes in common carp (*Cyprinus carpio*). Iranian Journal of Natural Resources, 58(2):373-382. In Farsi.

Sharifzadeh, S. A., Khara, H. and Ghobadi, Sh. 2014. The effect of vitamin E and B_2 (riboflavin) on growth, survival, hematological and immune factors of common carp fingerlings (*Cyprinus carpio*, Linnaeus 1758). Journal of Aquatic Animals and Fisheries, 5(19):51-61. In Farsi.

Sharifzadeh, S. A., Khara, H. and Ghobadi, Sh. 2016. The effect of vitamin B_2 (riboflavin) on growth, survival, blood and immune factors of fingerling common carp (*Cyprinus carpio*, Linnaeus 1758). Journal of Aquaculture Development, 10(2):77-85. In Farsi.

Sharma, B. P. 1988. Status of Schizothorax species in the Indian-Chinese Sub-Continent. Food and Agriculture Organization Indo-Pacific Fishery Commission, Bangkok (Thailand). Workshop on the Use of Cyprinids in the Fisheries Management of Larger Inland Water Bodies of the Indo-Pacific. 4. Session of the Indo-Pacific Fishery Commission Working Party of Experts on Inland Fisheries Commercial Species, Kathmandu (Nepal), 8-10 September 1988, FAO FIRI/405 (Supplement), pp. 90-94.

Sharma, K. P. 1980. Further studies on the fish marketing conditions of Southern Iraq. The Arab Gulf, Basrah, 2(1):223-228.

Sharma, R. C. 1984. Dynamics of food and feeding habits of *Crossocheilus latius* (Hamilton) in fluvial ecosystem of Garhwal Himalaya. Comparative Physiology and Biochemistry, 9(4):305-308.

Sharvashidze, V. A. 1984. Ryby vnutrennikh vodoemov Gruzinskoi SSR (Morfo-ekologicheskaya kharakteristika i khozyastvennoe znachenie) [Fishes of the interior reservoirs of Georgia (Morpho-ecological characteristics and economic significance)]. Izdatel’stvo “Sabchota Sakartvelo”, Tbilisi. 214 pp.

Shayegan, J. and Badakhshan, A.1996. Causes and effects of the water-level rise in the Caspian Sea. Lakes and Reservoirs: Research and Management, 2(1-2):97-100.

Shayeghi, M., Darabi, H., Abtahi Hosseini, M., Sadeghi Mohammad, P., Pakbaz, F. and Golestaneh, S. R. 2007. Assessment of persistence and residue of diazinon and malathion in three rivers (Mond, Shahpour and Dalaky) of Busheher Province; 2004-2005. Iranian South Medical Journal, 10(1):54-60. In Farsi.

Shayeghi, M., Shahtaheri, S. J. and Selsele, M. 2001. Phosphorous insecticides residues in Mazandaran River waters, Iran (2000). Iranian Journal of Public Health, 30(3-4):115-118.

Shayegi, M., Khoobdel, M., Bagheri, F., Abtahi, M. and Zeraati, H. 2012. Organophosphorous residue in *Liza aurata* and *Cyprinus carpio*. Asian Pacific Journal of Tropical Biomedicine, 2(7):564-569.

Shayestehfar, A., Soleimani, M., Mousavi, S. N. and Shirazi, F. 2008. Ecological study of rotifers from Kor river, Fars, Iran. Journal of Environmental Biology, 29(5):715-720.

Shcherbukha, A. Ya. 1973. Primenenie taksonomicheskogo analiza dlya vyyasneniya rodstvennykh svyazei mezhdu predstavitelyami rodov Abramis i Blicca (Pisces, Cyprinidae) [Use of taxonomic analysis for understanding the relationship between the members of genera Abramis and Blicca (Pisces, Cyprinidae)]. Zoologicheskii Zhurnal, 52(1):225-228.

Shearman, D. J. 1976. The geological evolution of southern Iran. The report of the Iranian Makran Expedition. Geographical Journal, 142(3):393-410.

Shehadeh, Z. H. 1997. West Asia, 4 pp. In: Review of the state of world aquaculture. Food and Agriculture Organization, Rome, Fisheries Circular, 886, Revision 1:163 pp.

Sheibak, H., Ghaffari, M., Gharaei, A., Touchaei, S. P. and Afshari, A. 2016. Comparison of digestive enzymes activity in *Schizothorax zarudnyi* intestine in wild and cultural conditions. Journal of Animal Environment, 8(2):133-138. In Farsi.

Sheibak, H. A., Ghaffari, M., Gharaei, A., Jahantigh, M. and Pakzad, S. 2015. Investigation of α-amylase, trypsin and lipase enzymes activities fluctuation in digestive tract of *Schizothorax zarudnyi*. Journal of Animal Environment, 7(2):205-210. In Farsi.

Sheikh, M., Hajimoradloo, A. M., Ghorbani, R., Mollaei, M. and Khodanazary, A. 2011. Effects of diazinon concentrations on LC_{50}, hematocrit and clinical signs of roach Torkemani (*Rutilus rutilus caspicus*) fries of Caspian Sea. Iranian Scientific Fisheries Journal, 20(3):55-62. In Farsi.

Sheikh, M. M., Rezaei, M. R. and Nasseri, M. A. 2013. Heavy metals (Hg, Cr and Pb) concentrations in water and sediment of Kashaf Rood River. Toxicology and Environmental Health Sciences, 5(2):65-70.

Sheikh, V. and Bahremand, A. 2011. Trends in precipitation and stream flow in the semi-arid region of Atrak River basin, North Khorasan, Iran. Biaban (Desert), Tehran, 16(1):49-60.

Sheikh, V. B. 2013. Analysis of hydroclimatic trends in the Atrak River basin, North Khorasan, Iran (1975-2008). International Journal of Environmental Resources Research, 1(3):233-246.

Sheikhi Moghaddam, L., Emtyazjoo, M. and Emadi, H. 2004. Alvita as alternative to malachite green in cold water fish systems. Journal of Environmental Science and Technology, 6(2):30-44. In Farsi.

Sheikh Veisi, R., Hedayati, S. A., Bagheri, T. and Nodeh, A. J. 2019. Study on growth performance and carcass composition of common carp (*Cyprinus carpio*) exposed to silver oxide nanoparticles and *Lactobacillus casei* probiotic. Journal of Animal Physiology and Development (Journal of Biological Sciences), 12:59-66. In Farsi.

Sheikhveisi, R., Hedayati, S. A., Jafar Nodeh, A., Snchooli, H., Ghani, S. and Bagheri, T. 2020. Effect of beet molasses pre-treatment on serum immunity indices of common carp (*Cyprinus carpio*) in exposure to iron nanoparticles. Journal of Aquaculture Sciences, 7(2):100-109. In Farsi.

Sheikhzadeh, H. and Hamidian, A. H., 2021. Bioaccumulation of heavy metals in fish species of Iran: a review. Environmental Geochemistry and Health, doi:10/1007/s10653-021-00883-5.

Sheikhzadeh, N. and Heidarieh, M. 2020. Effects of commercial synbiotic Biomin®IMBO on growth performance, some biochemical parameters and skin mucosal immunity in

crucian carp (*Carassius carassius*). Journal of Aquaculture Development, 14(2):55-65. In Farsi.

Sheikhzadeh, N. and Mousavi, Sh. 2019. Effects of green tea (*Camellia sinensis*) ethanolic extract on biochemical parameters and oxidative status in goldfish (*Carassius auratus*). Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 32(3):118-123. In Farsi.

Sheikhzadeh, N., Soltani, M., Ebrahimzadeh-Mousavi, H. A., Shahbazian, N. and Norouzi, M. 2011. Effects of *Zataria multiflora* and *Eucalyptus globolus* essential oils on haematological parameters and respiratory burst activity in *Cyprinus carpio*. Iranian Journal of Fisheries Research, 10(2):316-323.

Sheraliev, B., Allayarov, S. and Peng, Z. 2021. DNA barcoding revealed a wider distribution of *Alburnoides holciki* (Teleostei: Leuciscidae) in the inland waters of Uzbekistan. Journal of Applied Ichthyology, 37(4):601-606.

Sheykh Jabari, M. A. 1995. Study on the infestation of fishes in Shourabil lagoon by *Lernaea* spp. and *Ligula* spp. Ph.D. Thesis, Islamic Azad University, Karaj.

Sheykhi, M., Choobkar, N. and Aghajani, A. 2019. Evaluation of the effect of replacing red meat with *Cyprinus carpio* meat on physiochemical and textural properties of non-fermented sausage. Journal of Fisheries Science and Technology, 8(2):67-73. In Farsi.

Sheykhi, V. and Moore, F. 2012. Geochemical characterization of Kor River water quality, Fars Province, Southwest Iran. Water Quality, Exposure and Health, 4(1):25-38.

Sheykhi, V. and Moore, F. 2013. Evaluation of potentially toxic metals pollution in the sediments of the Kor River, southwest Iran. Environmental Monitoring and Assessment, 185(4):3219-3232.

Sheykhshoaei , F. and Mousavi Kouhpar, S. M. 2017. Fresh water fish, food resource used by the inhabitants of the Gowhar Tepe site, Mazandaran. Pazhohesh-ha-ye Bastanshenasi Iran, 7(13):243-257, In Farsi.

Sheykhzadeh, N., Soltani, M., Ebrahimzadeh Mousavi, H. A., Khosravi, A. R., Bagheri Hadi, F. E. A. and Zargar, A. 2009. Effects of *Eucalyptus globulus* labile essential oils on some immunological variables of common carp (*Cyprinus carpio*). Journal of Veterinary Research, 64(1):47-54. In Farsi.

Shiati, K. 1989. The origin and sources of salinity in river basins: A regional case study in southern Iran. International Association of Hydrological Sciences Publication, 182:201-210.

Shikhshabekov, M. M. 1969. Different forms of vobla, bream, and carp in the Arakum waters of Dagestan. Problems of Ichthyology, 9(1):34-38.

Shikhshabekov, M. M. 1977. Annual cycle of ovaries and testes in the tench, Tinca tinca, in the waters of Dagestan. Journal of Ichthyology, 17(4):685-689.

Shikhshabekov, M. M. 1979. The reproductive biology of the “kutum”, Rutilus frisii kutum, the asp, Aspius aspius, the vimba, Vimba vimba persa, and the rudd, Scardinius erythrophthalmus, in the waters of Dagestan. Journal of Ichthyology, 19(3):98-105.

Shilat, Tehran. 1994. Fisheries in Iran (Shilat). Shilat (Fisheries), Tehran. 212 pp. In Farsi (reports in other years too).

Shilat, Tehran. 1996. Consumer behaviour on fishery products in Tehran. Shilat (Fisheries), Tehran. 86 pp. In Farsi.

Shilat, Tehran. 1997a. Shilat Yearbook. Shilat (Fisheries), Tehran. 212 pp. In Farsi.

Shilat, Tehran. 1997b. Fisheries statistics. Comprehensive Development Studies Department,

Shilat (Fisheries), Tehran. 63 pp. In Farsi.
Shilat, Tehran. 1997c. Production, imports, exports and per capita fish consumption in Iran. Comprehensive Development Studies Department, Shilat (Fisheries), Tehran. 85 pp. In Farsi.
Shilat, Tehran. 1998a. Annual report of aquaculture production in Iran. Aquaculture Department, Shilat (Fisheries), Tehran. 168 pp. In Farsi. (annual reports in other years too).
Shilat, Tehran. 1998b. Fisheries production report in Iran. Shilat (Fisheries), Tehran. 67 pp. In Farsi.
Shir Mohammadi, F., Pourreza, J. and Mahboubi Soufiani, N. A. 2003. Effect of supplemental citric acid on growth performance and body composition of common carp (*Cyprinus carpio*). Iran Agricultural Research, 22(2):138-152.
Shirali, S., Erfani Majd, N., Mesbah, M. and Seifiabad Shapoori, M. R. 2011. Histological and histometrical study of common carp ovarian development during breeding season in Khouzestan Province in Iran. Iranian Journal of Veterinary Medicine, 5(4):260-268.
Shirali, S., Majd, N. E., Mesbah, M. and Seifi, M. R. 2012. Histological studies of common carp ovarian development during breeding season in Khouzestan Province, Iran. World Journal of Fish and Marine Sciences, 4(2):159-164.
Shirdel, I. and Kalbassi, M. R. 2014. Assessing the sensitivity of Caspian kutum (*Rutilus kutum*) and the endangered Caspian trout (*Salmo trutta caspius*) to acute toxicity of nonylphenol. Caspian Journal of Environmental Sciences, 12(2):225-232.
Shireman, J. V. and Smith, C. R. 1983. Synopsis of biological data on the grass carp, *Ctenopharyngodon idella* (Cuvier and Valenciennes, 1844). Food and Agriculture Organization, Rome, Fisheries Synopsis, 135:iv + 86 pp.
Shiri, S., Seidgar, M. and Najafpour, N. 2009. Ichthyotoxism in *Capoeta capoeta* from West Azerbaijan of Iran (Actinopterygii: Cyprinidae). 1st International Congress on Aquatic Animal Health Management and Diseases, 27-28 January 2009, Tehran (abstract).
Shirmohamadi, S., Eagderi, S. and Nikmehr, N. 2017. Morphological variation of the small-scald (*sic*) *Capoeta* in Tigris basin. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Shirmohammadi, H. and Mohammadnejad, M. 2021. Investigation of changes in some blood parameters of common carp (*Cyprinus carpio*) in different weights. Journal of Experimental Animal Biology, 9(3):43-53. In Farsi.
Shirvani, E. and Jamili, S. 2009. Assessing Cd, Pb accumulation in the tissues of *Chalcalburnus chalcoides* in Anzali Port. Research Journal of Environmental Sciences, 3(5):522-529.
Shiry, N., Khoshnoodifar, K. and Mirvaghefi, A. 2014. Toxicity and impacts of malathion on some blood indices in Caspian common carp (*Cyprinus carpio*). Journal of Fisheries Science and Technology, 3(2):1-11. In Farsi.
Shiry, N., Mirvaghefi, A., Talebi Jahromi, K. and Rafiee, G. 2015. Cholinesterase activity evaluation in *Capoeta capoeta gracilis* as biomarker of environmental monitoring in Gorgan-roud basin. Journal of Fisheries, 67(4):565-583, 8. In Farsi.
Shnitnikov, A. V. 1969. On the Holocene history of the Aral. Mitteilungen internationale Vereinigung für theoretische und angewandte Limnologie, 17(1):400-413.
Shoaei, S. M., Mirbagheri, S. A., Zamani, A. and Bazargan, J. 2014. Dissolved heavy metals in the reservoir of Shahid Rajaei Dam, Sari, Iran. International Journal of Environmental Research, 8(4):997-1004.
Shoghi, Z., Babakhani, A. and Pourfarzad, A. 2019. Effect of protein concentrate from bream

(*Abramis brama*) on chemical and cooking properties of pasta. Journal of Fisheries (Iranian Journal of Natural Resources), 72(2):156-167. In Farsi.

Shoghi, Z., Babakhani, A. and Pourfarzad, A. 2021. Use of bream fish meat (*Abramis brama*) in pasta production. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 9 pp. In Farsi.

Shohreh, P., Mehdizadeh Mood, S., Ghadam, M., Shafiei, Sh., Taheri Mirghaed, A. and Babaalian, A. 2013. Ectoparasites fauna of gold fish (*Carassius auratus*) in Mazandaran Province (Iran). Iranian Journal of Aquatic Animal Health, 1(1):40-45.

Shojaee, N., Dorafshan, S., Mirghaffari, N. and Talebi, M. 2014. Population genetic of *Petroleuciscus esfahani* (Teleostei: Cyprinidae) in Zayandeh Rood River, Iran. Journal of Taxonomy and Biosystematics, 6(21):1-10, 1.

Shojaei, D., Eagderi, S., Mouludi-Saleh, A. and Nasri, M. 2021. Morphological variation of endemic species, Saadi scraper (*Capoeta saadi* (*sic*)) from the Maharlu, Persis and Kor basins of Iran. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 6 pp. In Farsi.

Shojaei Kavan, L. 2010. Population genetic structure of *Rutilus frisii kutum* in Caspian Sea using biometry and microsatellite molecular technique. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 174 pp. In Farsi.

Shokoohi, S., Abdali, S., Yousefi Jourdehi, Y. and Negarestan, H. 2013. Investigation on biochemical responses of the silver carp (*Hypophthalmichthys molitrix*) under acute exposure to copper nitrate. Journal of Utilization and Cultivation of Aquatics, 2(2):143-152. In Farsi.

Shokoohi, Z., Rafiee, H. and Karimi, B. 2017. Survey of seasonal integration in farmed and wild fish markets in Fars Province. Eqtesad-e Keshavarzi va Towse'e, 25(99):203-219. In Farsi.

Shokri, M., Ahmadi, M., R., Rahmani, H. and Kamrani, E. 2015. Investigation of Tajan River quality with using population structure of benthic invertebrates and BWMP Index. Journal of Animal Environment, 6(4):221-230. In Farsi.

Shokri, M., Firouzbakhsh, F. and Rahmani, H. 2015. Prevalence and intensity of parasitic infection from *Hypophthalmichthys molitrix* and *Cyprinus carpio*. Journal of Animal Environment, 7(2):183-188. In Farsi.

Shokrolahi, S., Hosseinifard., S. M., Youssefi, M. R. and Sadough, M. 2014. Evaluation of parasite fauna in Fish of Alborz Dam. Journal of Parasitic Diseases, 40(1):129-131.

Shokrzadeh, M. and Ebadi, A. G. 2005. Investigating and measurement of residues of D.D.T. and D.D.E. in four species of fishes in Caspian Sea, Iran. International Journal of Biology and Biotechnology, 2(1):53-56.

Shokrzadeh, M. and Ebadi, A. G. 2006. Investigating and measurement of residues of chlorobenzilate (organochlorine pesticides) in four species of the most consumed fishes in Caspian Sea (Iran). Pakistan Journal of Nutrition, 5(1):68-70.

Shokrzadeh, M., Karimi, M. and Mohammadi, H. 2016. Diazinon residues in *Rutilus frisii kutum*, *Cyprinus carpio*, and leaping mullet in central coast of the Caspian Sea. Journal of Mazandaran University of Medical Sciences, 25(134):183-192. In Farsi.

Shokrzadeh, M., Saeedi Saravi, S. S. and Zehtab Yazdi, Y. 2009. Lindane residues in cultivated cucumber and in the most consumed fish in Caspian Sea (Iran). Toxicology and Industrial

Health, 25(8):517-523.
Shokrzadeh Lamuki, M., Saeedi Saravi, S. S. and Otadi, N. 2012. Evaluation of residues of D.D.T. and D.D.A. in fish collected from Caspian Sea, Iran. Iranian Journal of Toxicology, 6(18):704-708.
Shrestha, T. J. 2008. Ichthyology of Nepal. A Study of Fishes of the Himalayan Waters. Himalayan Ecosphere, Kathmandu. x + 388 pp.
Shukolyukov, A. M. 1932. Vozrast molodi ryb iz nizov'ev r. Urala v 1927 g [Age of young fishes from the lower reaches of the Ural River in 1927]. Izvestiya Instituta Ozernogo i Rechnogo Rybnogo Khozyaistva, 14:99-131.
Shutov, V. A. 1969. O revizii roda Blicca i nekotorykh pokazatelyakh fileticheskikh svyazei mezhdu predstavitelyami roda Abramis (Pisces, Cyprinidae) [Revision of the genus Blicca and some data concerning phyletic relationships between representatives of the genus Abramis (Pisces, Cyprinidae)]. Zoologicheskii Zhurnal, 48:1105-1107.
Siahkalroodi, S. Y., Khederzadeh, S. and Elmi, A. M. 2014. The nucleotide variation of the Iranian cave fish (*Iranocypris tyhlops*) using 12S rRNA gene sequencing. Journal of Animal Environment, 6(1):79-83, 11. In Farsi.
Siami, M., Keivany, Y. and Farhadian, O. 2014a. Back-calculation of length in (*Capoeta damascina*) in the Beheshtabad River. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 15-16 May 2014.
Siami, M., Keivany, Y. and Farhadian, O. 2014b. Scale and opercular length and age relationship in *Capoeta damascina* from Beheshtabad River. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 15-16 May 2014.
Siami, M., Keivany, Y. and Farhadian, O. 2014c. Some feeding characteristics of (*Capoeta damascina*) in the Beheshtabad River. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 15-16 May 2014.
Siami, M., Keivany, Y. and Farhadian, O. 2017. Reproductive characteristics of siahmahi, *Capoeta damascina* (Family: Cyprinidae) in Beheshtabad River, Tigris basin. Sri Lanka Journal of Aquatic Sciences, 22(1):21-27.
Sideleva, V. G. 2017. Contribution of Karl Fedorovich Kessler (1815-1881) to fish systematics and faunal research. Journal of Ichthyology, 57(3):473-483.
Silavi, M., Mousavi, S. M., Yavari, V., Savari, A. and Rajabzadeh, E. 2017. Spawning induction in anzeh (*Barbus esocinus*) by injection LHRH-A2 with pituitary gland extract. Journal of Animal Environment, 8(4):141-148. In Farsi.
Sil'chenko, G. F. 1976. Reproduction of sichel (Pelecus cultratus) stocks in Kuybyshev Reservoir. Journal of Ichthyology, 16(6):931-939.
Sima, S. and Ganjali, S. 2016. Developing a comprehensive approach for the determination of environmental water requirements of wetlands, pp. 62-71. In: Quanrud, D. (Ed.). U.S.-Iran Symposium on Wetlands. 28-30 March 2016. Irvine, California. 246 pp.
Sima, S. and Tajrishy, M. 2006. Modeling water allocation between wetland and irrigated agriculture: case study of the Jarrahi basin, Iran. 7th International Conference on Hydroinformatics, HIC 2006, Nice, 8 pp.
Simakani, P., Abolhassani, M. A. and Hoseini, S. M. 2018. Determination of mancozeb toxicity and biochemical effects in common carp (*Cyprinus carpio*). International Journal of Aquatic Biology, 6(3):157-161.
Singh, H. R. and Bahuguna, S. N. 1984. Eco-morphological adaptation of the gill rakers in

relation to the food and feeding habits of some hillstream fishes of Garhwal Himalaya. Věstník československé Společnosti zoologické, 48(1):64-68.

Singh, N. 1993. The scanning electron microscopic structure of the adhesive apparatus and mechanism of adhesion in hillstream teleost, *Crossocheilus latius latius* (Family-Cyprinidae) from Garhwal Himalaya. Journal of Animal Morphology and Physiology, 40(1 & 2):109-114.

Sinka Karimi, M. H., Mansouri, B., Donyavi, R. and Azadi, N. 2017. Evaluation of risks and limits of white fish, mullet and carp consumption in terms of lead concentration at the southeastern coast of the Caspian Sea: a systematic review and meta-analysis. Journal of Mazandaran University of Medical Sciences, 27(147):415-432. In Farsi.

Sinkakarimi, M. H., Donyavi, R. and Sadeghi Bajgiran, S. 2015. Consumption limit for Caspian withe (*sic*, white) fish in stand of cadmium and lead from southeastern coast of Caspian Sea. Zanko Journal of Medical Sciences, 16(49):32-43. In Farsi.

Sirang, H. 1997. Artificial propagation of tench (*Tinca tinca*) to fingerling size in 1994. Iranian Fisheries Scientific Journal, 6(2):43-52, 7-8. In Farsi.

Sizhong, L. 1995. On the geographical distribution of the Schizothoracine fishes (Cypriniformes, Cyprinidae). Sinozoologia,12:297-310. In Chinese.

Skandari, S. 1998. Investigation on some biological, ecological and parasitological characteristics of khramulya (*Capoeta capoeta gracilis*) in the river of Golestan National Park. M.Sc. Thesis, Tarbiat Modarres University, Tehran. 111 pp. In Farsi.

Smirnov, A. I. 1992. Reviziya taksonov roda podust *Chondrostoma* Agassiz, 1835 (Pisces, Cyprinidae) vostochnoy Evropy v predyelaj byvshego SSSR [Taxonomic revision of the genus *Chondrostoma* Agassiz, 1835 (Pisces, Cyprinidae) from eastern Europe and the former USSR]. Institut Zoologii, Akademii Nauk Ukrainy, Kiev. 63 pp.

Smith, A. 1951.Qanāts. Journal of the Iran Society, London, 1:86-90.

Smith, A. 1953. Blind white fish in Persia. George Allen and Unwin, London. 207 pp. (1966 Edition). Also in French with additional illustrations as “La Perse et ses mystères”, Plon, Paris. x + 274 pp. (1957).

Smith, A. 1977. Blind white fish discovery. The Illustrated London News, February 1977, p. 37, 39.

Smith, A. 1978. The blind fishes of Persia. Nature, London, 271(5647):711.

Smith, A. 1979. A Persian Quarter Century. Hodder and Stoughton, London. 192 pp.

Smith, A. 2004. Letter to the Editor. The Linnaean (Newsletter and Proceedings of the Linnaean Society of London), 20(3):16-17.

Smith, C., Phillips, A., Polačik, M. and Reichard, M. 2014. Male coloration signals direct benefits in the European bitterling (*Rhodeus amarus*). Environmental Biology of Fishes, 97(4):335-341.

Smith, C., Reichard, M., Jurajda, P. and Przybylski, M. 2004. The reproductive ecology of the European bitterling (*Rhodeus sericeus*). Journal of Zoology, London, 262(2):107-124.

Smith, K. G., Barrios, V., Darwall, W, R. T. and Numa, C. (Eds.). 2014. The Status and Distribution of Freshwater Biodiversity in the Eastern Mediterranean. Cambridge, U.K., Malaga, Spain and Gland, Switzerland, IUCN. xiv + 132 pp.

Snyder, J. A., Wasylik, K., Fritz, S. C. and Wright, H. E. 2001. Diatom-based conductivity reconstruction and palaeoclimatic interpretation of a 40-ka record from Lake Zeribar, Iran. Holocene, 11(6):737-745.

Sobhan Ardakani, S. and Jafari Seyed, M. 2014. Assessment of heavy metals (Cu, Pb and Zn) in

different tissues of common carp (*Cyprinus carpio*) caught from Shirinsu Wetland. Journal of Chemical Health Risks, 4(2):47-54.

Sobhanardakani, S. and Jafari, S. M. 2014a. Heavy metals contamination in silver, common and grass carp caught from Zarivar Lake, western Iran. European Online Journal of Natural and Social Sciences, 3(2):344-350.

Sobhanardakani, S. and Jafari, S. M. 2014b. Investigation of As, Hg, Zn, Pb, Cd and Cu concentrations in muscle tissue of *Cyprinus carpio*. Journal of Mazandaran University of Medical Sciences, 24(116):184-195. In Farsi.

Södergren, A., Djirsarai, R., Gharibzadeh, M. and Moinpour, A. 1978. Organochlorine residues in aquatic environments in Iran, 1974. Pesticides Monitoring Journal, 12(2):81-86.

Soghly, A. and Hashemzadeh Segherloo, I. 2015. Genetic barcoding of *Chondrostoma regium* (Heckel, 1843) in Karun and Sirvan rivers. Journal of Applied Ichthyological Research, 3(3):35-46. In Farsi.

Soheilnaghshi, P., Ershad Langroudi, H. and Koochakian Saboor, A. 2015. Effective of rosemary extract on lipid quality of silver carp (*Hypophthalmichthys molitrix*) during ice storage. Journal of Aquatic Ecology, Hormozgan University, 5(1):121-126. In Farsi.

Sohrabi, A., Hoseinifar, S. H., Kolangi Miandare, H. and Jafari, V. 2021. The effects of guava (*Psidium guajava*) leaves powder on growth performance and some blood serum parameters in common carp (*Cyprinus carpio*) fingerlings. Journal of Applied Ichthyological Research, 8(3):83-91. In Farsi.

Sohrabi, H. I. and Jalali, J. B. 2002. Observation of a nematod (*sic*) (*Schulmanella petruschewskii*, Schulman (*sic*)) infection in a barble (*sic*) (*Barbus koswigi* (*sic*)) in Iran. Iranian Journal of Marine Sciences, 1(2):47-50, 84. In Farsi.

Sohrabi, M., Imanpour, M. R., Azarin, H. and Mehdinejad, N. 2013. Determination of some hematological parameters of *Vimba vimba persa* during reproductive migration. World Journal of Fish and Marine Sciences, 5(3):286-290.

Solak, K. 1977. Çoruh-Aras Havzası, Caner ve Murzu Balıklarının (Barbus Türleri) Dağılışında Populasyon Dinamiği Üzerine Araştırmalar [Investigations on the population dynamics of the Barbus species (Caner and Murzu) in the Çoruh-Aras basin].Ege Üniversitesi Fen Fakültesi Dergisi, Seri B, 1(4):361-374.

Solak, K. 1978. Çoruh ve Aras Havzasında Yaşayan Üç Barbus (Cyprinidae) Türü Barbus plebejus BON., Barbus mursa (GÜLD.), Barbus capito (GÜLD.) [Three Barbus (Cyprinidae) species living in the Çoruh and Aras basins Barbus plebejus BON., Barbus mursa (GÜLD.), Barbus capito (GÜLD.)]. Doğa Bilim Dergisi, 2(3):161-167.

Solak, K. 1989a. Aras Havzasında Yaşayan *Barbus plebejus lacerta* Heckel, 1843'nin (Cyprinidae, Pisces) Yaş-Boy ve Yaş-Ağırlık Ilişkileri Üzerine Araştırmalar [Studies on age-length and age-weight relationships of *Barbus plebejus lacerta* Heckel, 1843 (Cyprinidae, Pisces) living in the Aras basin]. Doğa Türk Zooloji Dergisi, 13(1):28-33.

Solak, K. 1989b. Kura ve Aras Havzasışayan *Barbus mursa mursa* (Güldenstadt, 1773)'nin (*Cyprinidae, Pisces*) Yaş-Boy ve Yaş-Ağırlık Ilişkileri Üzerine Araştırmalar [Investigations on the age-length and age-weight relations of *Barbus mursa mursa* (Güldenstadt, 1773) (*Cyprinidae, Pisces*) inhabiting Kura and the Aras basins].Doğa Türk Zooloji Dergisi, 13(1):34-38.

Solak, K. 1989c. Çoruh ve Aras Havzası'nin Bazı Derelerinda Yaşayan *Barbus capito capito* (Güldenstadt, 1773)'nun Yaş-Ağırlık ve Yaş-Boy Dağılımı [Age-length and age-weight distribution of *Barbus capito capito* (Güldenstadt, 1773) inhabiting some streams of the

Çoruh and the Aras basins].Doğa Türk Zooloji Dergisi, 13(2):109-118.
Soleimani, N., Mohammadi, Gh. and Khodadadi, M. 2014. Study on genetic diversity of cultured *Cyprinus carpio* in Khuzestan by using microsatellite. New Cellular and Molecular Biotechnology Journal, 4(14):93-98. In Farsi.
Soleimani, N., Hoseinifar, S. H., Barati, M. and Hassan Abadi, Z. 2012. The effects of prebiotic oligofructose on some growth factors, survival, body composition and resistance to salinity stress of Caspian roach (*Rutilus rutilus*) fry. Iranian Scientific Fisheries Journal, 21(1):113-122. In Farsi.
Soleimani, N., Hoseinifar, S. H., Merrifield, D. L., Barati, M. and Abadi, Z. H. 2012. Dietary supplementation of fructooligosaccharide (FOS) improves the innate immune response, stress resistance, digestive enzyme activities and growth performance of Caspian roach (*Rutilus rutilus*) fry. Fish and Shellfish Immunology**,** 32(2):316-321**.**
Soleimanian, S., Amini Chermahini, M. Eagderi, S. and Savari, A. 2021. Body shape changes of shirbot, *Arabibarbus grypus* (Heckel, 1843) during early development using geometric morphometric method. Journal of Aquaculture Sciences, 8(15):58-64. In Farsi.
Soleimany, V., Banaee, M., Mohiseni, M., Haghi, B. N. and Mousavi Dehmourdi, L. 2015. Effects of pre-clinical administration of marshmallow extract (*Althea officinalis* L.) on certain hepatopancreatic enzymes in common carp (*Cyprinus carpio*). Journal of Aquatic Ecology, Hormozgan University, 4(4):41-52. In Farsi.
Soleimany, V., Banaee, M., Mohiseni, M., Nematdoost Haghi, B. and Mousavi Dehmourdi, L. 2016. Evaluation of pre-clinical safety and toxicology of *Althaea officinalis* extracts as naturopathic medicine for common carp (*Cyprinus carpio*). Iranian Journal of Fisheries Sciences, 15(2):613-629.
Soleymani, N., Hajimoradlou, A. A., Ghorbani, R., Khoushbavar Rostami, H. A. and Hasanabadizadeh, Z. 2008. Effect of different levels of injectable vitamin C on common carp, *Cyprinus carpio* survival challenged by different doses of theront of *Ichthyophthirius multifilis*. Journal of Agricultural Sciences and Natural Resources, 15(6):132-138. In Farsi.
Soleymani, S., Sadeghi Limanjoob, R., Golchin Manshadi, A. and Najafian, B. 2015. The investigation of caught fish abundance in two season, summer and autumn in the Karun River catchment in the City of Ahwaz. Advances in Environmental Biology, 9(4):568-572.
Solgi, E., Alipour, H. and Majnooni, F. 2018. Assessment of heavy metal concentrations in the muscles of common carp (*Cyprinus carpio* L., 1758) from the southern coast of the Caspian Sea and potential risks to human health. Iranian Scientific Fisheries Journal, 27(1):119-129. In Farsi.
Solgi, E., Bigdeli, H. and Solimany, A. 2019. The levels of heavy metals of copper, zinc and iron in muscle and gill tissues of the three species of (*Carassius auratus*), (*Vimba persa*) and (*Luciobarbus capito*) in the Manjil Dam. Journal of Applied Biology, 32(3):39-53. In Farsi.
Solgi, E. and Khatoni, S. 2015. Evaluation of some heavy metal levels in Zarivar international wetland by monitoring of *Cyprinus carpio*. Journal of Animal Environment, 7(3):109-118. In Farsi.
Solgi, E. and Mohammadi Galangashi, M. 2018. Assessing the health of marine and lacustrine wetland using measurement of heavy metals in fish species: Case study from two Iranian international wetland (Gomishan and Zarivar). Environmental Nanotechnology,

Monitoring and Management, 10:73-78.
Solijinov, S. 2007. Review on a fish fauna of the Pamir-Alai transboundary conservation area (overview report). Report on the Establishment of Pamir-Alai transboundary conservation area between Kyrgyzstan and Tajikistan. Dushanbe. 8 pp.
Soltani, M. 2000. Study of lethal toxicity and histopathological effects due to organochlorine pesticide, endosulfan, in common cap (*Cyprinus carpio*). The Third World Fisheries Congress, Beijing, 31 Oct - 2 Nov 2000 (title).
Soltani, M. 2003. The status of aquaculture health management in Iran. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).
Soltani, M. 2017. Study of combined effect of fructo-oligosaccharide with *Pediococcus acidilactici* and *Lactococcus lactis* as probiotics on some growth performance, haematology and intestine bacterial flora of *Rutilus frisii kutum* larvae. Journal of Fisheries Science and Technology, 5(4):71-83. In Farsi.
Soltani, M. 2021. The role of exotic pathogens (imported diseases) in the destruction of native fishes stocks. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Soltani, M., Abdy, E., Alishahi, M., Taheri Mirghaed, A. and Hosseini-Shekarabi, P. 2107. Growth performance, immune-physiological variables and disease resistance of common carp (*Cyprinus carpio*) orally subjected to different concentrations of *Lactobacillus plantarum*. Aquaculture International, 25(5):1913-1933.
Soltani, M., Bozorgnia, A., Seyedpour Seyede, R., Barzegar, M. and Taheri Mirghaed, A. 2014. Concentration of heavy metals Cu, Cd and Pb in liver, gonad and muscle of the Caspian kutum, *Rutilus kutum* and the Caspian roach *Rutilus rutilus* in the southeast coasts of Caspian Sea. Journal of Marine Biology, 6(2):45-54. In Farsi.
Soltani, M. and Ghaeni, M. 2015. Research needs in Iran aquaculture. Middle East Aquaculture Forum, Dubai International Convention and Exhibition Center, Dubai, United Arab Emirates, 5-6 April 2015 (abstract).
Soltani, M., Ghafari, M., Khazraeinia, P. and Bokaei, S. 2004. Effects of clove oil (*Eugenia caryophyllata*) anesthesia on haematological parameters, certain serum enzymes and some tissues in common carp (*Cyprinus carpio*). Journal of Veterinary Research, 59(3):295-299. In Farsi.
Soltani, M., Kalbassi, M. R., Mohammad Nazar, R. and Mostafvi, H. 2001. Therapeutic effects of formalin on hatch rate of common carp (*Cyprinus carpio*) eggs under farmed conditions in Shahid Rajaii Centre, Sari, Iran. Journal of the Faculty of Veterinary Medicine, University of Tehran, 56(4):69-71. In Farsi.
Soltani, M., Mikryakov, V. R., Lapirova, T. B., Zabotkina, E. A. and Popov, A. V. 2003. Assessment of some immune response variables of immunized common carp (*Cyprinus carpio*) following exposure to organophosphate, malathion. Bulletin of the European Association of Fish Pathologists, 23(1):18-24.
Soltani, M., Moghimi, S. M., Ebrahimzade Mousavi, H., Abdi, K. and Soltani, E. 2016. Isolation, phenotypic and molecular characterization of motile *Aeromonas* species, the cause of bacterial hemorrhagic septicemia in affected farmed carp in Iran. Iranian Journal of Veterinary Medicine, 10(3):209-216.
Soltani, M. and Pourgholam, R. 2007. Lysozyme activity of grass carp (*Ctenopharingodon* (*sic*) *idella*) following exposure to sublethal concentrations of organophosphate, diazinon.

Journal of Veterinary Research, 62(2):49-52. In Farsi.
Soltani, M., Pourgholam, R., Kazemi, B. and Hassan, M. D. 2003. Purification and partial characterization of serum immunoglobulin from grass carp (*Ctenopharyngodon idella*). Bulletin of the European Association of Fish Pathologists, 23(3):102-107.
Soltani, M., Sheikhzadeh, N., Ebrahimzadeh-Mousavi, H. A. and Zargar, A. 2010. Effects of *Zataria multiflora* essential oil on innate immune responses of common carp (*Cyprinus carpio*). Journal of Fisheries and Aquatic Sciences, 5(3):191-199.
Soltani, S., Sarhadi, A. and Ebrahimi, E. 2016. Determination of environmental water requirements of the Gavkhuni Wetland, Iran: a comparison of ecological and hydrological approaches. Journal of Wetlands Biodiversity, 6:47-60.
Soltani, Z., Gharzi, A. and Rouhi, A. 2011. The study of the fishes fauna in Bidoaz River of Esfarayen. Journal of Animal Biology, 4(1):47-56. In Farsi.
Soltani, Z., Ghorbani, R., Hedayati, S. A. A., Adeli, A. and Mazandarani, M. 2015. The comparison of sub lethal concentration effects of zinc sulfate and zinc nano-oxide on gill histopathological lesions of *Capoeta capoeta gracilis* (Keyserling, 1861). Journal of Applied Ichthyology Research, 2(4):13-22. In Farsi.
Soltanian, S., Akhlaghi, M., Adloo, M. N., Ghadimi, N. and Fereidouni, M. S. 2017. Aqueous extract of *Heracleum persicum* Desf. enhances immune response of common carp, *Cyprinus carpio*, and protection against *Aeromonas hydrophila*. Iranian Journal of Science and Technology, Transactions A: Science, 41(3):645-657.
Soltanian, S., Safaeian, S., Hosseini, A. G., Mirougaf, A. and Shiri, N. 2017. Evaluation of siah mahi *Capoeta razii* in the Gorganrud, Agh-Qal District, Golestan Province. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).
Soltanian, S., Vazirzadeh, A. and Akbary, P. 2017. Effect of praziquantel on hemato-immunological indices in common carp (*Cyprinus carpio*). Iranian Journal of Science and Technology, Transactions A: Science, 42(3):1015-1025.
Somesarai, M. N., Mohseni Masoleh, F. and Atshani, M. 2018. Investigation of the effects of Persica plant extract on reducing bacterial load of *Carassius auratus*. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).
Soofiani, M. N. and Asadollah, S. 2010. Some aspects of growth and reproduction of *Capoeta damascina* Valenciennes, 1842 from the Hanna wetland, Semirom. Iranian Scientific Fisheries Journal, 18(4):145-156. In Farsi.
Soofiani, N., Asadollah, S., Abdoli, A., Ahmadi, S. and Pooramini, M. 2011. Growth and reproductive characteristics of *Squalius lepidus* Heckel 1843 in the Dimeh Spring of Zayandeh-rud River. Iranian Scientific Fisheries Journal, 20(2):121-130. In Farsi.
Sorosh Hadad, M., Imanpour Namin, J., Nasrollahzade, A. and Sattari, M. 2018. Length and weight ratio, gonadosomatic and hepatosomatic indexes (*sic*), growth patterns and condition factor of *Alburnus chalcoides* in the southwest coastlines of the Caspian Sea (Guilan Province). Journal of Fisheries (Iranian Journal of Natural Resources), 71(3):286-293. In Farsi.
Soufi, M., Kiabi, B., Zehzad, B., Nasarzade, H. and Riazi, B. 2010. A study of human-related factors on the biodiversity of lagoons (case study: a comparison between Solokli and Shormasts lagoons, north of Iran. Linnaeus ECO-TECH ´10, Kalmar, Sweden, November 22-24, 2010. 14 pp.

Spärck, R. 1962. Anton Frederik Bruun 14. December 1901 - 13. December 1961. ICES Journal of Marine Science, 27(2):121-123.
Spataru, P. and Gophen, M. 1985. Feeding behaviour of silver carp *Hypophthalmichthys molitrix* Val. and its impact on the food web in Lake Kinneret, Israel. Hydrobiologia, 120(1):53-61.
Spataru, P. and Gophen, M. 1986. Food and feeding habits of *Capoeta damascina* (Cyprinidae) in Lake Kinneret, Israel. Journal of Aquaculture in the Tropics, 1:147-153.
Spencer, A. M. (Ed.). 1974. Mesozoic-Cenozoic Orogenic Belts. Data for Orogenic Studies. Special Publication, Geological Society, London, 4:xvi + 809 pp.
Spillman, C. J. 1972. Sur une collection de poissons (Cyprinidae, Poeciliidae) recueillis dans le sud-est de l'Iran. Bulletin du Muséum national d'Histoire naturelle, Paris, 41:581-584.
Stakei, A. 1999. Stressful chemical factors in the water bodies of Parishan Lake. Iranian Scientific Fisheries Journal, 8(2):15-30, 2. In Farsi.
Stakei, A. A. 1999. Determination of nutrients, BOD and COD in manured polyculture ponds. Iranian Scientific Fisheries Journal, 8(3):1-22, 1. In Farsi.
Starostin, I. V. 1936. Ikhtiofauna rechek severnogo sklona Kopet-Daga [Ichthyofauna of the streams of the northern Kopet-Dag]. Byulleten' Turkmenskoi Zoologicheskoi Stantsii, 1936(1):81-97.
Starostin, I. V. 1992. Fauna vnutrennikh vodoemov Turkmenistana [Fauna of the interior reservoirs of Turkmenistan]. Ylym, Ashgabat. 256 pp.
Stchoukine, I. 1936. La peinture iranienne sous les derniers `Abbâsides et les Îl-Khâns. Bruges. 188 pp., XLVI pl.
Steindachner, F. 1864. Ichthyologische Mittheilungen. (VII.). I. *Scaphiodon Capoëta* Heck. Verhandlungen der Zoologisch-Botanischen Gesellschaft, Wien, 14:223-234.
Steindachner, F. 1866. Zur Fischfauna Kaschmirs und der benachbarten Länderstriche. Ichthyologische Mittheilungen IX (VI). Verhandlungen der Zoologisch-Botanischen Gesellschaft, Wien, 16, 9(6):784-796 Tafs. XIII, XIV, XVI, XVII.
Stephenson, J. 1928. The Zoological Section of the Nuzhatu-l-Qulūb of Hamdullāh al-Mustaufī Al-Qazwīnī. Oriental Translation Fund, New Series, 30:xix + 100 pp.
Stevens, L. R., Wright, H. E. and Ito, E. 2001. Proposed changes in seasonality of climate during the Late glacial and Holocene at Lake Zeribar, Iran. Holocene, 11(6):747-755.
Steyskal, G. C. 1980. The grammar of family-group names as exemplified by those of fishes. Proceedings of the Biological Society of Washington, 93(1):168-177.
Stiassny, M. L. J. and Getahun, A. 2007. An overview of labeonin relationships and the phylogenetic placement of the Afro-Asian genus *Garra* Hamilton, 1922 (*sic*) (Teleostei: Cyprinidae), with the description of five new species of *Garra* from Ethiopia, and a key to all African species. Zoological Journal of the Linnaean Society, 150(1):41-83.
Stierandová, S., Vukič, J., Vasil'eva, E. D., Zogaris, S., Shumka, S., Halačka, K., Vetešník, L., Švátora, M., Nowak, M., Stefanov, T. and Koščo, J. 2016. A multilocus assessment of nuclear and mitochondrial sequence data elucidates phylogenetic relationships among European spirlins (*Alburnoides*, Cyprinidae). Molecular Phylogenetics and Evolution, 94(Part B):479-491.
Stöcklin, J. 1968. Structural history and tectonics of Iran: A review. Bulletin of the American Association of Petroleum Geologists, 52(7):1229-1258.
Stöcklin, J. 1974a. Northern Iran: Alborz Mountains, pp. 213-234. In: Spencer, A. M. (Ed.). Mesozoic-Cenozoic Orogenic Belts: data for Orogenic Studies. Geological Society of

London Special Publication, 4.
Stöcklin, J. 1974b. Possible ancient continental margins in Iran, pp. 873-887. In: Burk, C. A. and Drake, C. L. (Eds.). The Geology of Continental Margins. Springer-Verlag, New York. xiii + 1009 pp.
Stone, R. 2002. Caspian ecology teeters on the brink. Science, 295(5554):430-433.
Stone, R. 2005. Attack of the killer jellies. Science, 309(5742):1805-1806.
Stone, R. 2007. The last of the leviathans. Science, 316(5832):1684-1688.
Stone, R. 2015. Saving Iran's great salt lake. Science, 349(6252):1044-1047.
Stone, R. 2018. Bringing an Iranian oasis back from the dead. Science, 359(6378):854-855.
Stoneley, R. 1974. Evolution of the continental margins bounding a former southern Tethys, pp. 889-903. In: Burk, C. A. and Drake, C. L. (Eds.). The Geology of Continental Margins. Springer-Verlag, New York. xiii + 1009 pp.
Storch, G. 1980. Spätglaziale Kleinsäuger der Ali Tepeh-Höhle (Behshar). Zur klima-ökologischen Faunengeschichte in NE-Iran. Senckenbergiana biologica, 60(5/6)(1979):285-302.
Stoumboudi, M. Th., Villwock, W., Sela, J. and Abraham, M. 1993. Gonadosomatic index in *Barbus longiceps*, *Capoeta damascina* and their natural hybrid (Pisces, Cyprinidae), versus spermatozoan index in the parental males. Journal of Fish Biology, 43(6):865-875.
Stout, C. C., Tan, M., Lemmon, A. R., Lemmon, E. M. and Armbruster, J. W. 2016. Resolving Cypriniformes relationships using an anchored enrichment approach. BMC Evolutionary Biology, 16:244.
Stratil-Sauer, G. 1937. Kanate, Persiens künstliche Bewässerungsanlagen. Die Umschau, Frankfurt, 41(12):271-275.
Street, W. S., Street, J. K. with Sawyer, R. 1986. Iranian Adventure. The First Street Expedition. Field Museum of Natural History, Chicago. x + 305 pp.
Strubalina, N. K. and Chernyavskiy, V. I. 1992. Growth of northern Caspian roach, *Rutilus rutilus caspicus*, under contemporary environmental conditions. Journal of Ichthyology, 32(6):43-51.
Su, R.-F., Yang, J.-X. and Chen, Y.-R. 2000. A review of the Chinese species of *Crossocheilus*, with description of a new species (Ostariophysi: Cyprinidae). Raffles Bulletin of Zoology, 48(2):215-221.
Sudagar, M. 2017a. Effect of dietary turmeric (*Curcuma longa*) addition on growth performance and survival rate against salt-water stress in common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 6(2):21-30. In Farsi.
Sudagar, M. 2017b. The effect of antibacterial properties of zinc oxide nanoparticles on total count of bacterial and gram-negative bacteria in the fresh water aquariums with goldfish (*Carassius auratus* Linnaeus, 1758). Journal of Animal Researches (Iranian Journal of Biology), 31(3):262-272. In Farsi.
Sudagar, M., Hamidi Kenari, M., Shabanpour, B. and Lotfi Orimi, R. 2012. Comparison of slaughtering Chinese carps (grass carp, bighead, silver carp) and common carp with ordinary method and using electricity and its effects on some indices of the fish's meat. Journal of Animal Environment, 2012(3):27-36. In Farsi.
Sudagar, M., Poorsabet, S. S., Zakariaee, H. and Dadgar, S. 2016. Effect of ovaprim, ovafact hormones and pituitary extract on artificial reproduction of white fish *Rutilus kutum* (Kamensky, 1901). Journal of Applied Ichthyological Research, 4(3):53-64. In Farsi.
Sungur, S., Eagderi, S., Jalili, P. and Çiçek, E. 2020. Caudal osteology and its application to

reconstruct phylogenetic relationship in the genus *Garra*. Su Ürünleri Dergisi (Ege Journal of Fisheries and Aquatic Sciences), 37(3):245-249.

Sungur Birecikligil, S., Fricke, R. and Çiçek, E. 2017. First record and distribution of *Alburnus qalilus* Krupp, 1992 (Teleostei: Cyprinidae) in Turkey. International Journal of Aquatic Biology, 5(1):47-51.

Surber, E. W. 1969. Report to the Government of Iran on a programme for the development of the Inland Fisheries of Iran. Food and Agriculture Organization, Rome, United Nations Development Programme, Technical Assistance, UNDP (TA) 2723:viii + 64 pp.

Sutcliffe, J. V. and Carpenter, T. G. 1967. The assessment of runoff from a mountainous and semi-arid area in western Iran. Bulletin of the International Association of Scientific Hydrology, 76:383-394.

Svetovidova, A. A. 1967. Sistematika sredneaziatskikh el'tsov roda *Leuciscus* (Cyprinidae Pisces) [Taxonomy of the dace genus *Leuciscus* (Cyprinidae Pisces) from Central Asia]. Voprosy Ikhtiologii, 7(6)(47):979-989.

Svetovidova, A. A. 1978. [List of holotypes, syntypes and paratypes kept in the Department of Ichthyology of the Moscow State University Museum]. Sbornik Trudov Zoologicheskogo Muzeya MGU (Archives of the Zoological Museum of Moscow State University), 16:256-263.

Svetovidov, A. N. 1945. *Chalcalburnus chalcoides iranicus* subsp. nova from the Caspian coast of Iran, and some zoogeographical problems of the southern part of this sea. Comptes Rendus de l'Academie des Sciences de l'URSS, 48(2):142-144. In English.

Svetovidov, A. N. 1949. Ryby Irana po materialam, sobrannym akad. E. N. Pavlovskim [Fishes of Iran from material collected by Acad. E. N. Pavlovskii]. Trudy Zoologicheskogo Instituta Akademii Nauk SSSR, 8:859-869.

Svetovidov, A. N. 1981. The Pallas fish collection and the Zoographia Rosso-Asiatica: an historical account. Archives of Natural History, 10(1):45-64.

Svojtka, M., Salvini-Plawen, L. and Mikschi, E. 2009. Biographischer Abriss zu Johann Jakob Heckel (1790-1857). Österreichs Fischerei, 62:285-288.

Svojtka, M., Salvini-Plawen, L. and Mikschi, E. 2012. Johann Jakob Heckel (1790-1857), der Begründer der systematischen Ichthyologie in Österreich: Ein biographischer Überblick. Schriften Verein zur Verbreitung naturwissenschaftlicher Kenntnisse, 148-150:43-74.

Syed Mortezaii, S. 2002. Protozoan infections of fresh water fishes in Khouzestan Province. Pajouhesh va Sazandegi, 51:86-89. In Farsi.

Sykes, E. C. 1898. Through Persia on a Side-Saddle. A. D. Innes & Co., London. vii + 362 pp.

Sykes, P. 1927. Sir John Chardin's Travels in Persia. The Argonaut Press, London. xxx + 287 pp.

Sykes, P. M. 1902. Ten thousand miles in Persia; or, eight years in Iran. John Murray, London. 481 pp., map.

Syzpuła, J., Epler, P., Bartel, R. and Szczerbowksi, J. A. 2001. Age and growth of fish in lakes Tharthar, Razzazah and Habbaniya. Archives of Polish Fisheries, 9(supplement 1):185-197.

Szczerbowksi, J. A., Bartel, R. and Epler, P. 2001. Fishing gear selectivity, fish survival rates and resources in lakes Tharthar, Habbaniya and Razzazah. Archives of Polish Fisheries, 9(supplement 1):225-233.

T

Taati, M. M., Mehrad, B. and Shabani, A. 2010. The effect of ascorbic acid on hatching performance and tolerance against environmental stressor (high temperature) by immersion of Prussian carp (*Carassius gibelio*) fertilized eggs. AACL Bioflux, 3(3):219-226.

Taati, M. M., Mehrad, B., Shabani, A. and Golpour, A. 2010a. Investigation of chemical composition of ceolomic (*sic*) fluid and its effect on sperm motility traits in Prussian carp, *Carassius gibelio*, during spawning season. AACL Bioflux, 3(3):227-232.

Taati, M. M., Mehrad, B., Shabani, A. and Golpour, A. 2010b. Correlation between chemical composition of seminal plasma and sperm motility characteristics of Prussian carp (*Carassius gibelio*). AACL Bioflux, 3(3):233-238.

Taati, R., Ahmadizadeh, M. and Valipour, A. R. 2016. Determination of growth performance, changes of carcass composition and blood parameters in common carp fingerlings (*Cyprinus carpio*) fed with different levels of vitamin E. Journal of Veterinary Research, 71(1):65-72. In Farsi.

Taati, R., Mokhayer, B., Azari Takami, G. and Tolouei Gilani, M. H. 2009. Isolation and identification of parasites of kutum fingerlings (*Rutilus frisii kutum*) in governmental cultivated ponds in Guilan Province. Journal of Fisheries, 3(1):35-42. In Farsi.

Taati, R. and Noei Taadoli, H. 2015. Determination of growth performance and some hematological and immune parameters of common carp (*Cyprinus carpio*) fingerlings fed different levels of dietary herbal additive including carvacrol, anethole and limonene. Journal of Marine Biology, 7(1):35-42. In Farsi.

Taati, R., Salavatian, S. M., Ghorbani, S. A. and Dashtiari, F. 2019. Effect of partial replacing fish meal with wheat gluten on growth indices and carcass composition of Caspian kutum (*Rutilus kutum*). Journal of Animal Physiology and Development (Journal of Biological Sciences), 12(2):39-49. In Farsi.

Tabandeh, M-R., Abdy, E. and Makipour, M. 2014. The tissue distribution of rhodanese in different species of the genus *Barbus* (*B. sharpeyi*, *B. grypus*, *B. xanthopterus* and *B. barbulus*). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tabandeh, M-R., Abdy, E. and Mehranfar, M. 2014. Activity of mercaptopyruvate sulphurtransferase in different tissues of the genus *Barbus* (*B. sharpeyi*, *B. grypus*, *B. xanthopterus* and *B. barbulus*). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tabari, H., Marofi, S. and Ahmadi, M. 2011. Long-term variations of water quality parameters in the Maroon River, Iran. Environmental Monitoring and Assessment, 177(1-4):273-287.

Tabari, S., Saeedi Saravi, S. S., Bandany, G. A., Dehghan, A. and Shokrzadeh, M. 2010. Heavy metals (Zn, Pb, Cd and Cr) in fish, water and sediments sampled from southern Caspian Sea, Iran. Toxicology and Industrial Health, 26(10):649-656.

Tabari, S. Y., Karami, B., Shokrzadeh, M., Akbarzadeh A., Layali, I., Abrvash, E. and Ebadi, A. G. 2012. Heavy metals (Pb, Cd and Cr) in water collected from Gorgan Rood River, Iran. Bulletin of Environment, Pharmacology and Life Sciences, 1(9):89-91.

Tabatabaei, S. N., Hashemzadeh-Segherloo, I., Abdoli, A., Milani, M. and Mirzaei, R. 2015. Age and growth of spirlins, *Alburnoides eichwaldii* and *A. namaki*, from the Caspian, Kavir and Namak basins of Iran. Iranian Journal of Ichthyology, 1(4)(2104):266-273.

Tabatabaei, S. N., Hashemzadeh-Segherloo, I., Eagderi, S. and Zamani, M. 2015. Length-weight relationships of fish species in Kordan River (Namak Lake basin), Iran. Journal of

Applied Ichthyology, 31(4):800-801.
Tabatabai, S. M., Nafisi Bahabadi, M., Zamanpour, M. and Tabatabai, S. Z. 2020. Nutritional ecology and nutritional indicators of Qara Aqhaj butak *Cyprinion tenuiradius* Heckel, 1847 in Firoozabad River Valley, Fars Province. Journal of Aquatic Ecology, Hormozgan University, 9(3):154-161. In Farsi.
Tabatabai Niko, N., Hosseini Shekarabi, S. P. and Hosseini, S. E. 2020. The effect of adding *Gracilaria persica* macroalgae on some physicochemical properties of common carp sausage during refrigerated storage. Journal of Utilization and Cultivation of Aquatics, 9(3):27-41. In Farsi.
Tabatabaie, T., Ghomi, M, R., Amiri, F. and Zamani-ahmadmahmoodi, R. 2011. Comparative study of mercury accumulation in two fish species, (*Cyprinus carpio* and *Sander lucioperca*) from Anzali and Gomishan wetlands in the southern coast of the Caspian Sea. Bulletin of Environmental Contamination and Toxicology, 87(6):674-677.
Tabibi, A., Mousavi, S. M., Yavari, V., Zakeri, M., Jahedi, A. and Zanoosi, H. P. 2017. Effects of activating solutions on performance of artificial propagation of *Luciobarbus xanthopterus* and *Ctenopharyngodon idella*. Journal of Experimental Animal Biology, 5(3):39-50. In Farsi.
Tabibi, R. 2001. Ecology and parasitology on fishes and importance of zoonotic parasitic diseases in Khuzestan Province. M.Sc. Thesis, University of Tehran. 118 pp.
Tabiee, O., Boustani, F. and Vatandoust, S. 2014. The ichthyofauna of the Beshar River in Kohkiluyeh and Boyer-Ahmad Province, southwest Iran. Iranian Journal of Animal Biosystematics, 10(1):29-35.
Tabrizi, S., Ghodsypour, S. H. and Ahmadi, A. 2017. A bi-level optimization modeling for perishable food supply chain: the case of a warm-water farmed fish supply chain in Iran. Iranian Journal of Trade Studies, 21(84):169-204. In Farsi.
TACIS (Technical Assistance to the Commonwealth of Independent States, European Union). 1999. Proposed scheme of fishery resource management. Caspian Environment Programme Facilitating Thematic Advisory Groups in Azerbaijan, Kazakhstan, Russia & Turkmenistan, Caspian Regional Thematic Center on Management of Fish Resources and other Commercial Bioresources on a Sustainable Basis (CRTC MB), Baku, Azerbaijan. 25 pp.
TACIS (Technical Assistance to the Commonwealth of Independent States, European Union). 2000a. Country report on desertification Islamic Republic of Iran. Caspian Environment Programme Facilitating Thematic Advisory Groups in Azerbaijan, Kazakhstan, Russia & Turkmenistan, Baku, Azerbaijan. iii + 23 pp.
TACIS (Technical Assistance to the Commonwealth of Independent States, European Union). 2000b. Proposal for a management system for the transboundary fishery resources of the Caspian Sea. Caspian Environment Programme Facilitating Thematic Advisory Groups in Azerbaijan, Kazakhstan, Russia & Turkmenistan, Baku, Azerbaijan. v + 76 pp.
TACIS (Technical Assistance to the Commonwealth of Independent States, European Union). 2000c. Assessment of pollution control measures I. R. Iran. Caspian Environment Programme Facilitating Thematic Advisory Groups in Azerbaijan, Kazakhstan, Russia & Turkmenistan, Baku, Azerbaijan. 22 pp.
TACIS (Technical Assistance to the Commonwealth of Independent States, European Union) and United Nations Development Programme. 2002. Transboundary diagnostic analysis for the Caspian Sea. Caspian Environment Programme, Baku, Azerbaijan. Volume 1:viii

+ 26 pp., Volume 2:iv + 128 pp., Volume 3:i + 11 annexes + 13 pp.
Tadajewska, M. 1998. Pharyngeal teeth and shape of the *ossa pharyngea inferiora* during development of *Abramis brama* (L.) and *Blicca bjoerkna* (L.) (Cyprinidae). Cybium, 22(2):123-147.
Taghavi, F., Alipoor Eskandani, M., Saadati, D. and Arshadi, A. 2020. Effects of aqueous and ethanol extracts of pomegranate peel (*Punica granatum*) on the growth of inoculated *Escherichia coli* in (*Cyprinus carpio*) minced meat. Journal of Fisheries, 73(3):383-394. In Farsi.
Taghavi, S. A. 2000. Fisheries monitoring, control and surveillance in the Islamic Republic of Iran. Country paper 5. In: FAO Report of a Regional Workshop on Fisheries Monitoring, Control and Surveillance, FAO/Norway Programme of Assistance to Developing Countries for the Implementation of the Code of Conduct for Responsible Fisheries. Food and Agriculture Organization, Rome.
Taghavi-Jeloudar, M., Han, M., Davoudi, M. and Kim, M. 2013. Review of ancient wisdom of qanat, and suggestions for future water management. Environmental Engineering Research, 18(2):57-63.
Taghavi Jolodar, H. and Amiri Sahebi, A. 2016. Evaluation of biological characteristics such as age, sexuality and growth parameters of fish roach (*Rutilus rutilus caspicus*) in the southeastern coasts of the Caspian Sea (Sari and Turkmen ports). Iranian Scientific Fisheries Journal, 25(1):183-192. In Farsi.
Taghavi Motlagh, S. A., Gorgin, S., Fazli, H. and Abdolmalaki, S. 2011a. Effect of beach seine height and mesh size on catch characteristics in the southern part of the Caspian Sea. Journal of Fisheries International, 6(2):36-40.
Taghavi Motlagh, S. A., Gorgin, S., Fazli, H. and Abdolmalaki, S. 2011b. Effect of beach seine height and mesh size on catch characteristics in the southern part of the Caspian Sea. International Journal of Fisheries and Aquaculture, 3(9):184-190.
Taghavi Niya, M., Javaheri Baboli, M. and Pazira, A. 2017. Effect of temperature and salinity on growth and reproduction of female *Capoeta trutta* in Shour River, South West of Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 481-487. In Farsi.
Taghavi Niya, M., Javaheri Baboli, M., Roomiani, L. and Pazira, A. 2015. Study on growth parameters of *Capoeta trutta* (Heckel, 1843) in Shour River, Iran. Iranian Journal of Fisheries Sciences, 14(1):262-274.
Taghavi Niya, M. and Velayatzadeh, M. 2015. Evaluation of the frequency and diversity of fish species in Shour River, Khozestan province. Journal of Applied Ichthyological Research, 3(3):47-58. In Farsi.
Taghiof, M., Nikoo, M. and Pourshamsian, K. 2012. Proximate and fatty acid composition of salted Caspian kutum (*Rutilus frisii*) roes influenced by storage temperature and vacuum-packaging. World Journal of Fish and Marine Sciences, 4(5):525-529.
Taghiyan, H., Sahapouri, M., Mohammadi, V. and Alizadeh, A. 2016. A survey on biodiversity, abundance and distribution of Dinorab River fish. Breeding and Aquaculture Sciences Quarterly, 3(7):29-42. In Farsi.
Taghizadeh, V., Imanpoor, M. R., Hosseinzade, M. and Azarin, H. 2013. Effects of acidic water in combination with aluminum on swimming behavior and survival of yolk-sac larvae in goldfish (*Carassius auratus gibelio*). World Journal of Fish and Marine Sciences, 5(4):461-466.

Taghizadeh, V., Imanpoor, M. R. and Mehdinejad, N. 2013. Study the (*sic*) seasonal steroid hormones of common carp in Caspian Sea, Iran. World Journal of Fish and Marine Sciences, 5(4):457-460 (see also SpringerPlus, 2013, 2:193).

Taghizadeh, V., Imanpoor, M. R. and Sadeghi, A. 2013. Effect of extenders and different concentrations of methanol on motility parameters of goldfish (*Carassius auratus gibelio*) spermatozoa after short-term storage. World Journal of Fish and Marine Sciences, 5(5):492-496.

Taghizadeh, V., Imanpoor, M. R., Sadeghi, A. and Shaluei, F. 2013. Effect of extenders and different concentrations of dimethyl sulphoxide on goldfish (*Carassius auratus gibelio*) sperm. World Journal of Fish and Marine Sciences, 5(5):514-518.

Taghizadeh, V., Imanpour, M. R., Azerami, H. and Hosseinzadeh, M. 2013. The responses of the yolk-sac fry of goldfish (*Carassius auratus gibelio*) to low pH and aluminium: sodium exchange, development and activity. Journal of Utilization and Cultivation of Aquatics, 2(4):1-13. In Farsi.

Taghizadeh Rahmat Abadi, Z., Abtahi, B., Grossart, H.-P. and Khodabandeh, S. 2021. Microplastic content of Kutum fish, *Rutilus frisii kutum* in the southern Caspian Sea, Science of the Total Environment, 752:141542.

Taha, M. F., Harb, S. A., Nagib, M. K. and Tantawy, A. H. 1981. The Climate of the Near East, pp. 183-255. In: Takahashi, K. and Arakawa, H. (Eds.). Climates of Southern and Western Asia. Elsevier, Amsterdam. xiii + 333 pp.

Tahami, F. 2014. Comparison of morphological parameters and serum protein bioassay of kutum fish (*Rutilus frisii kutum*) in estuaries and rivers of Tajan and Shiroud. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tahami, F. and Ghiasi, M. 2013. Comparison of serum markers and protein bioassay of white fish (*Rutilus frisii kutum*) in estuaries and rivers of Tajan and Shiroud. Journal of Aquaculture Development, 7(3):23-31. In Farsi.

Tahami, F. S. 2018. A comparative study of plankton and pelagic fishes in the southeast Caspian Sea (Mazanderan-Goharbaran). Caspian Sea Ecology Research Center, Iranian Fisheries Science Research Institute, Ministry of Jihad-e Agriculture, Tehran. 52 pp. In Farsi.

Tahami, M. S., Esmaeili, H. R. and Monsefi, M. 2018. Reproductive biology of an endemic fish, *Alburnoides qanati* Coad and Bogutskaya, 2009 (Teleostei: Cyprinidae) from Southern Iran. Caspian Journal of Environmental Sciences, 16(2):135-148.

Tahami, M. S., Esmaeili, H. R. and Sadeghi, S. 2015. Feeding biology of *Alburnoides qanati* from Kor River basin (Teleostei: Cyprinidae). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 89-90.

Tahami, M. S., Esmaeili, H. R. and Safaie, M. 2015. Population dynamic parameters of the highly endemic fish, *Alburnoides qanati* Coad and Bogutskaya 2009, (Teleostei: Cyprinidae) in the Kor River basin, Iran. International Journal of Aquatic Biology, 3(2):119-128.

Tahami, M. S., Khaefi, R. and Esmaeili, H. R. 2011. Invasion of non-endemic fish (*Carassius* spp. (Actinopterygii: Cypriniformes) to inland waters of Iran and its effect on endemic species. International Conference on Indigenous Knowledge for Biodiversity Conservation (ICIKBC2011), Kerman (abstract). In Farsi.

Tahbaz, M. 2016. Environmental challenges in today’s Iran. Iranian Studies, 49(6):943-961.

Taheri, H. and Aliasghari, M. 2012. Effect of starvation and compensation growth on growth and body composition of *Rutilus rutilus caspicus* fry. Journal of Utilization and Cultivation of Aquatics, 1(1):81-92. In Farsi.

Taheri, M. R., Hafezieh, M., Dakhili, M. and Javadi, A. 2014. Identification of intestinal bacterial flora of reared kutum fish (*Rutilus frisii kutum*) in Qom. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Taheri, S., Banaee, M., Nematdoost Haghi, B. and Mohiseni, M. 2017. Effects of dietary supplementation of zinc oxide nanoparticles on some biochemical biomarkers in common carp (*Cyprinus carpio*). International Journal of Aquatic Biology, 5(5):286-294.

Taheri Mirghaed, A., Akhondzade Basti, A. and Ebrahimzadeh Mousavi, G. 2013. Effect of *Zataria multiflora* essential oil on the growth of *Staphylococcus aureus* in the light salted fillets of silver carp *Hypophthalmichthys molitrix.* Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Taheri Mirghaed, A., Barzegar, M., Ebrahimzadeh Mousavi, H., Rahmati-holasoo, H. and Bozorgnia, A. 2017. A comparative study of parasite communities of some endemic fish species in the Alborz Dam and the Babol River in the southern Caspian Sea basin, Mazandaran Province. International Journal of Aquatic Biology, 5(6):401-407.

Taheri Mirghaed, A., Ebrahimzadeh Mousavi, H., Moeini Jazani, M., Rahmati-Holasoo, H. and Bozorgnia, A. 2018. Parasite fauna of chub, *Squalius turcicus* De Filippi, 1865 (Teleostei: Cyprinidae) from some rivers of the southern Caspian Sea basin in Iran. Iranian Journal of Ichthyology, 5(2):109-117.

Taheri Mirghaed, A., Enayati, A., Soltani, M., Alishahi, M., Rahmati-Holasoo, H., Haghighi Khiabanian Asl, A. and Hosseini Shekarabi, P. 2019. Study of koi herpes virus disease (KHVD) in some carp farm of Iran: A molecular and pathological study. Iranian Veterinary Journal, 15(2):69-78. In Farsi.

Taheri Mirghaed, A., Fayaz, S. and Hoseini, S. M. 2019. Effects of dietary 1,8-cineole supplementation on serum stress and antioxidant markers of common carp (*Cyprinus carpio*) acutely exposed to ambient ammonia. Aquaculture, 509:8-15.

Taheri Mirghaed, A. and Ghelichpour, M., 2019. Effects of anesthesia and salt treatment on stress responses, and immunological and hydromineral characteristics of common carp (*Cyprinus carpio*, Linnaeus, 1758) subjected to transportation. Aquaculture, 501:1-6.

Taheri Mirghaed, A., Ghelichpour, M., Hoseini, S. M. and Jiminez, A. P. 2020. Effect of chronic flonicamide intoxication on blood ions concentration and gill and kidney damage in common carp (*Cyprinus carpio*). Journal of Aquaculture Sciences, 8(1):1-7. In Farsi.

Taheri Mirghaed, A., Mazandarani, M., Hajimoradloo, A. M., Vali, S. and Niazi, A. 2019. Survey on helminth parasites of common carp (*Cyprinus carpio*) in the southeastern part of the Caspian Sea. Journal of Applied Ichthyological Research, 7(2):95-104. In Farsi.

Taheri Mirghaed, A., Paknejad, H. and Mirzargar, S. S. 2020. Hepatoprotective effects of dietary artemisia (*Artemisia annua*) leaf extract on common carp (*Cyprinus carpio*) exposed to ambient ammonia. Aquaculture, 527:735443.

Taheri-Garavand, A., Fatahi, S. and Banan, A. 2019. Intelligent classification of common carp (*Cyprinus carpio*) based on freshness using the combined of image processing techniques and adaptive neuro-fuzzy inference system. Iranian Journal of Biosystems Engineering (Iranian Journal of Agricultural Sciences), 49(4):645-657. In Farsi.

Taheri-Garavand, A., Nasiri, A., Banan, A. and Zhang, Y-D. 2020. Smart deep learning-based approach for non-destructive freshness diagnosis of common carp fish. Journal of Food Engineering, 278:109930.

Taherianfard, M., Ebrahimi, M. and Soodbaksh, S. 2008. Bioaccumulation of mercury in fishes of Kor River. Australian Journal of Basic and Applied Sciences, 2(4):904-908.

Tahmasebi, A., Keivany, Y. and Farhadian, O. 2014a. The length-weight relationship in Kura barb, *Barbus lacerta* Heckel, 1843, from Caspian Sea basin. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tahmasebi, A., Keivany, Y. and Farhadian, O. 2014b. The length-weight relationship in Kura barb, *Barbus lacerta* Heckel, 1843, from Urmia basin. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tahmasebi, A., Keivany, Y. and Farhadian, O. 2014c. Body shape variations in Kura barb populations (*Barbus lacerta* Heckel, 1843). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Tajari, M., Kamali, A., Rajabi Eslami, H. and Paknejad, H. 2019. The effect of sublethal doses of endosulfan on hematological, biochemical factors and immunity of mucus in roach (*Rutilus caspicus*). Journal of Animal Environment, 11(1):167-174. In Farsi.

Tajbakhsh, F., Pazooki, J., Masoumian, M. and Daghigh Rouhi, J. 2010. The first record of *Philometra rischta* (Nematoda: Philometridae) in *Blicca bjoerkna* of Anzali wetland, Iran. Iranian Journal of Fisheries Sciences, 9(3):485-488.

Tajdar Nasrabadi, M. and Akrami, R. 2014. Effects of fructo- and mannan oligosaccharide supplements on growth performance, survival rate, body biochemical composition and resistance rate of roach (*Rutilus rutilus*) fry. Journal of Oceanography, 4(16):33-44. In Farsi.

Tajik, Z. and Keivany, Y. 2015a. Geometric morphometric analysis of body shape in two populations of Urmia bleak in Nazloochai and Barandouz rivers. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 73.

Tajik, Z. and Keivany, Y. 2015b. Length-weight relation in *Alburnus atropatenae* from Zarrinehruod River (*sic*). The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 80.

Tajik, Z. and Keivany, Y. 2018. Body shape comparison of Urmia bleak populations, *Alburnus atropatenae*. Journal of Animal Environment, 10(2):149-160. In Farsi.

Takeh, Sh., Imanpour, M. R., Sodagar, M. and Shabani, A. 2010. Investigation of semen biochemical changes at the broodstock spawning migration times of mahisefid (*Rutilus frisii kutum* Kamensky 1901). Iranian Journal of Biology, 23(2):190-196. In Farsi.

Takeh, Sh., Imanpour, M. R., Sudagar, M. and Shabani, A. 2008. The effects of ions ratio on semen biological characteristics in kutum (*Rutilus frisii kutum*). Journal of Marine Sciences and Technology, 7(1-2):63-74. In Farsi.

Takeh, Sh., Imanpour, M. R., Sudagar, M. and Shabani, A. 2009. Comparison of some spermatological and biochemical parameters of semen in mahisefid (*Rutilus frisii kutum*) at different of broodstock spawning migration times. Journal of Agricultural Sciences and Natural Resources, 16(special issue 2):53-62. In Farsi.

Takesh, M., Chamani, A. and Mortazavi, S. 2018. The lead concentration in the water and common carp (*Cyprinus carpio*) in Choghakhor international wetland. Journal of Animal Environment, 10(4):317-324. In Farsi.

Taki, Y. 1975. Cyprinid fishes of the genera *Onychostoma* and *Scaphiodonichthys* from Upper Laos, with remarks on the dispersal of the genera and their allies. Japanese Journal of Ichthyology, 22(3):143-150.

Takin, M. 1972. Iranian geology and continental drift in the Middle East. Nature, London, 235(5334):147-150.

Talaei, F. and Daryadel, E. 2015. A case study of Anzali Lagoon in the framework of Ramsar Convention challenges and solutions. International Law Review, 32(52):277-312. In Farsi.

Talebi, K. 1998. Diazinon residues in the basins of Anzali Lagoon, Iran. Bulletin of Environmental Contamination and Toxicology, 61(4):477-483.

Talebi Haghighi, D., Falahi Kapour Chali, M. and Abd Elah Tabar, S. Y. 2010. The effect of different levels of Biomin®Imbo synbiotic on growth and survival of *Rutilus frisii kutum* fry. New Technologies in Aquaculture Development (Journal of Fisheries), 4(3):1-14. In Farsi.

Talebzadeh, S. T., Vahabzadeh, H. and Khara, H. 2017. Comparison inhibiting effect of chloramine T and methylene blue on skin and gills bacterial and fungal loads of koi carp (*Cyprinus carpio*). Journal of Aquaculture Development, 11(3):53-60. In Farsi.

Taleghani, M., Hoseini, S. M. and Omidzahir, S. 2019. The protective effect of Damask rose, *Rosa damascena* extract on the liver of *Cyprinus carpio* following zinc exposure. International Journal of Aquatic Biology, 7(5):315-321.

Taleshi, K., Osoli, N. and Moradi, M. 2013. Rice growth pattern analysis in fish-rice culture. World Applied Sciences Journal, 22(7):1019-1023.

Talwar, P. K. 1978. Identity of the schizothoracid fish genus *Schizothorax* Heckel, 1838, with considerations of the status of *Schizothoraichthys* Misra, 1962. Bulletin of the Zoological Survey of India, 1(1):81-85.

Talwar, P. K. and Jhingran, A. G. 1991. Inland Fishes of India and Adjacent Countries. Oxford & IBH Publishing Company, New Delhi. 2 volumes.

Tan, M. and Armbruster, J. W. 2018. Phylogenetic classification of extant genera of fishes of the order Cypriniformes (Teleostei: Ostariophysi). Zootaxa, 4476(1):6-39.

Tandon, K. K., Johal, M. S. and Kaur, J. 1989. On the systematics, age and growth of *Labeo dero* from Gobindsagar, Himachal Pradesh, India. Věstnik československé Společnosti zoologické, 53:54-65.

Tang, K. L., Agnew, M. K., Chen, W-J., Hirt, M. V., Raley, M. E., Sado, T., Schneide, L. M., Yang, L., Bart, H. L., He, S., Liu, H., Miya, M., Saitoh, K., Simons, A. M., Wood, R. M. and Mayden, R. L. 2011. Phylogeny of the gudgeons (Teleostei: Cyprinidae: Gobioninae). Molecular Phylogenetics and Evolution, 61(1):103-124.

Tang, K. L., Agnew, M. K., Hirt, M. V., Sado, T., Schneider, L. M., Freyhof, J., Sulaiman, Z., Swartz, E., Vidthayanon, C., Miya, M., Saitoh, K., Simons, A. M., Wood, R. W. and Mayden, R. L. 2010. Systematics of the subfamily Danioninae (Teleostei: Cypriniformes: Cyprinidae). Molecular Phylogenetics and Evolution, 57(1):189-214.

Tangestani, R., Alizadeh Doughikolaee, E. and Elyasi, A. 2010. An analysis of the organoleptic properties of three types of fish fingers produced from silver carp flesh. Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):1-10. In Farsi.

Tao, W., Mayden, R. L. and He, S. 2013. Remarkable phylogenetic resolution of the most complex clade of Cyprinidae (Teleostei: Cypriniformes): a proof of concept of homology assessment and partitioning sequence data integrated with mixed model Bayesian analyses. Molecular Phylogenetics and Evolution, 66(3):603-616.

Taqvaie, M. and Ramezani, A. 2002. Characteristics of tourism in Chaharmahal-Bakhtiari Province. Environment, Tehran, 37:20-27 (www.netiran.com/Htdocs/WeeklyJournal/Social/wj01140.html, downloaded 12 February 2002).

Tarahi Tabrizi, S. 2001. Study of pesticide residues (diazinon, malathion, metasytoux) in the Tabriz Nahand River. M.Sc. Thesis, Tehran University of Medical Science, Tehran.

Tarahomi, M., Ghanbar Dezfuli, S. M. and Golchin Manshadi, A. R. 2015. Survey on the incidence of *Lernaea* sp. on the common carp (*Cyprinus carpio*) in the rearing ponds of Shushtar, lies in Khuzestan province during warm season. New Technologies in Aquaculture Development (Journal of Fisheries), 10(3):75-80. In Farsi.

Taravati, S., Askary Sary, A. and Javaheri Baboli, M. 2012. Determination of lead, mercury and cadmium in wild and farmed *Barbus sharpeyi* from Shadegan Wetland and Azadegan. Bulletin of Environmental Contamination and Toxicology, 89(1):78-81.

Tari, F., Imanpour Namin, J., Abdolmalaki, S. and Hadavi, M. 2015. Reproductive biology of Caspian vimba, *Vimba vimba* (L.), in the coastal waters of the southwestern Caspian Sea. Archives of Polish Fisheries, 23(3):171-180.

Taridashti, F., Imanpour, J., Abdolmalaki, S. and Hadavi, M. 2017.Life history traits and fishing mortality estimations of Caspian vimba, *Vimba vimba* (L.), in southwestern coastal regions of the Caspian Sea. Archives of Polish Fisheries, 25(3):145-155.

Taridashti, F., Imanpour Namin, J., Abdolmalaki, S. and Hadavi, M. 2013. Length-weight relationships of Caspian vimba (Cyprinidae: *Vimba vimba persa*, Pallas, 1811) in southwestern coasts of the Caspian Sea (Guilan province). The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 64 (abstract).

Tarkan, A. S., Gaygusuz, Ö., Acıpınar, H. and Gürsoy, Ç. 2005. Characteristics of a Eurasian cyprinid, shemaya, *Chalcalburnus chalcoides* (Güldenstädt, 1772), in a mesotrophic water reservoir. Zoology in the Middle East, 35(1):49-60.

Tarkhani, R. 2013. Effects of dietary 17-β estradiol on growth, nutrition indicator and sex reversal in goldfish (*Carassius auratus gibelio*). Journal of Utilization and Cultivation of Aquatics, 2(3):27-35. In Farsi.

Tarkhani, R. and Hedayati, S. A. A. 2013. Investigation of acute toxicity of two pesticides on goldfish, *Carassius auratus gibelio*. Journal of Utilization and Cultivation of Aquatics, 2(2):121-131. In Farsi.

Tarkhani, R., Imani, A., Hoseinifar, S. H., Ashayerizadeh, O., Sarvi, K., Manaffar, R., Vandoan, H. and Reverter, M. 2019. Comparative study of host-associated and commercial probiotic effects on serum and mucosal immune parameters, intestinal microbiota, digestive enzymes activity and growth performance of roach (*Rutilus rutilus caspicus*) fingerlings. Fish and Shellfish Immunology, 98:661-669.

Tarkhani, R., Imani, A., Hoseinifar, S. H., Sarvi Moghanlou, K. and Manaffar, R. 2020.

The effects of host-associated *Enterococcus faecium* CGMCC1.2136 on serum immune parameters, digestive enzymes activity and growth performance of the Caspian roach (*Rutilus rutilus caspicus*) fingerlings. Aquaculture, 519:734741.

Tarkhani, R. and Imanpoor, M. R. 2012. Stress response of *Carassius auratus* to salt and formaldehyde exposure. World Journal of Fish and Marine Sciences, 4(5):486-488.

Tarkhani, R., Imanpoor, M. R. and Taghizadeh, V. 2012. Effect of dietary 17•estradiol on serum sex hormones' levels and gamete quality in goldfish (*Carassius auratus*). World Journal of Fish and Marine Sciences, 4(6):637-644.

Tarkhani, R., Imanpoor, M. R., Vajargah, M. F. and Hossain, S. A. 2015. Negative effect of 17-beta-estradiol on growth parameters of goldfish (*Carassius auratus*). Journal of Coastal Life Medicine, 3(3):183-186.

Tarkhasi, A., Alizadeh Doughikolaee, E. and Sedaghat, M. 2014. Organoleptic assessment of three types of fish fingers prepared from common carp (*Cyprinus carpio*). Journal of Fisheries Science and Technology, 3(2):51-57. In Farsi.

Tarkhasi, A., Zakipour Rahmabadi, I., Elahi, M. Y., Alizadeh Dughkalayi, E. and Mostafa, Y. E. 2016. Effect of edible coating containing pomegranate (*Punica granatum*) peel extract on the quality and shelf life of silver carp (*Hypophthalmichthys molitrix*) fillet during refrigerated storage. Journal of Fisheries Science and Technology, 5(2):17-27. In Farsi.

Tasa, H., Imani, A. and Sarvi Moghanlou, K. 2018. Investigating the protective efficacy of rosemary and thyme against dietary aflatoxin B1 toxicity in common carp (*Cyprinus carpio*) fingerlings. Journal of Fisheries (Iranian Journal of Natural Resources), 71(1):82-92. In Farsi.

Tasa, H., Imani, A., Sarvi Moghanlou, K., Nazdar, N. and Moradi-Ozarlu, M. 2020. Aflatoxicosis in fingerling common carp (*Cyprinus carpio*) and protective effect of rosemary and thyme powder: Growth performance and digestive status. Aquaculture, 527:735437.

Tataati, R. and Salehi, M. 2018. Comparison of hematological and biochemical parameters of common carp (*Cyprinus carpio*) fed separate and combined levels of commercial multi-enzymes. Journal of Applied Ichthyological Research, 6(2):119-124. In Farsi.

Tatar, R., Ghorbani, R., Gorgin, S., Bandani, Gh. A. and Yahyaei, M. 2018. Determination of exploitation model for *Rutilus caspicus* in south east of Caspian Sea (Golestan Province). Journal of Utilization and Cultivation of Aquatics, 7(2):9-19. In Farsi.

Tate, G. P. 1910. Seistan. A memoir on the history, topography, ruins, and people of the country. Superintendent Government Printing, Calcutta. Volume 1:1-271, 5 maps, photos; volume 2:272-378, index 17 pp.

Tatina, M., Taati, R. and Gharibkhani, M. 2009. Occurrence and intensity of metazoan parasites from pike (*Esox lucius*, L.) and roach (*Rutilus rutilus caspicus*, J.) in Bodjagh Wetland of Kiashahr. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 3(6):23-32. In Farsi.

Tavakol, M., Arjmandi, R., Shayeghi, M., Monavari, S. M. and Karbassi, A. 2017. Application of multivariate statistical methods to optimize water quality monitoring network with emphasis on the pollution caused by fish farms. Iranian Journal of Public Health, 46(1):83-92.

Tavakol, S., Abdi, K., Hosseinzadeh, M. and Mohseni, B. 2011. Occurrence and distribution of *Aeromonas* spp. in goldfish (*Carassius auratus*) farms in Guilan Province, Iran. World Journal of Fish and Marine Sciences, 3(5):468-472.

Tavakol, S., Amin, O. M., Luus-Powell, W. J. and Halajian, A. 2015. The acanthocephalan fauna of Iran, a check list. Zootaxa, 4033(2):237-258.

Tavakoli, H. R. and Razavilar, V. 2003a. The toxin detection of proteolytic and non-proteolytic types of *Clostridium botulinum* in fishes from Southern and Northern Iran. AquaEuro 2003, European Aquaculture Society, Trondheim, Norway, August 8-12, 2003 (title).

Tavakoli, H. R. and Razavilar, V. 2003b. Isolation of *Clostridium botiulinum* (*sic*) (types A, B, E) in sediments from coastal areas in the north of Iran. Iranian Journal of Public Health, 32(3):37-40.

Tavakoli, H. R., Soltani, M. and Bahonar, A. 2012. Isolation of some human pathogens from fresh and smoked shad (*Alosa kessleri*) and silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Fisheries Sciences, 11(2):424-429.

Tavassoli, A. and Moghir, B. 2002. Squamous cell carcinoma of oral cavity in *Rutilus frisii* of Caspian Sea (the first case report). Book of Abstracts, 27th World Veterinary Congress, September 25-29, 2002, Tunis-Tunisia (abstract).

Taziki, T., Jafari, V., Mazandarani, M. and Hosseinifar, S. H. 2021. Effect of dietary supplementation with L-proline and L-alanine amino acids on immunity, hematological and survival in face of salinity stress in common carp (*Cyprinus carpio*). Journal of Applied Ichthyological Research, 8(4):77-86. In Farsi.

Tedesco, P. A., Oberdorff, T., Cornu, J-F., Beauchard, O., Brosse, S., Dûrr, H. H., Grenouillet, G., Leprieur, F., Tisseuil, C., Zaiss, R. and Hugueny, B. 2013. A scenario for impacts of water availability loss due to climate change on riverine fish extinction rates. Journal of Applied Ecology, 50(5):1105-1115.

Tehranifard, A., Fazeli, M. and Yarrabi, J. 2007. Determination of LC50 of linear anionic detergents and diazinon toxin on *Rutilus frisii kutum*. Marsh Bulletin, 2(2):147-154.

Tehranifard, A., Moshfegh, A. and Nokandeh, S. N. 2018. Investigation of the process of changes in blood, immunity, ions, testicular tissue and hormonal tissue of whitefish and its relationship with fish age (*Rutilus kutum*) in winter and spring seasons of Chaf and Wahmakhaleh (*sic*, Chamkhaleh) of Guilan province. Journal of Animal Environment, 10(3):229-240. In Farsi.

Tehranifard, A., Sharif Fazeli, M. and Piri, M. 2002. Determination of LC50 of linear anionic detergents and diazinon toxin on *Rutilus frisii kutum*. Iranian Journal of Marine Sciences, 1(1):55-59, 81. In Farsi.

Teimori, A. 2006. Preliminary study of freshwater fish diversity in Fars province. M.Sc. Thesis, Shiraz University, Shiraz. In Farsi.

Teimori, A. 2016. Scanning electron microscopy of scale and body morphology as taxonomic characteristics of two closely related cyprinid species of genus *Capoeta* Valenciennes, 1842 in southern Iran. Current Science, 111(7):1214-1219.

Teimori, A. and Esmaeili, H. R. 2007. Ichthyodiversity and its conservation in inland water of Iran. Biodiversity Conservation Imperative, University of Tehran, Iran (oral presentation).

Teimori, A. and Esmaeili, H. R. 2008. Endemic fish diversity of Iran and its conservation status. International Congress on Documenting, Analysing and Managing Biodiversity in the Middle East, Amman, Jordan (poster).

Teimori, A., Esmaeili, H. R. and Ansari, T. H. 2011. Micro-structure consideration of the adhesive organ in doctor fish, *Garra rufa* (Teleostei; Cyprinidae) from the Persian Gulf basin. Turkish Journal of Fisheries and Aquatic Sciences, 11(3):407-411.

Teimori, A., Esmaeili, H. R. and Gholamhosseini, A. 2010. The ichthyofauna of Kor and Helleh River basins in southwest of Iran with reference to taxonomic and zoogeographic features of native fishes. Iranian Journal of Animal Biosystematics, 6(1):1-8.

Teimori, A., Esmaeili, H. R. and Motamedi, M. 2009. Freshwater ichthyodiversity, threats and conservation status in desert habitats of Iran with emphasis on qanats systems. 13th European Congress of Ichthyology, 6-12 September 2009, Klaipeda, Lithuania (abstract).

Teimori, A., Esmaeili, H. R., Sayyadzadeh, G., Zarei, N. and Gholamhosseini, A. 2015. Molecular systematics and distribution review of the endemic cyprinid species, Persian chub, *Acanthobrama persidis* (Coad, 1981) in Southern Iran (Teleostei: Cyprinidae). Molecular Biology Research Communications, 4(4):189-206.

Teimori, A., Mostafavi, H. and Esmaeili, H. R. 2016. An update note on diversity and conservation of the endemic fishes within Iranian inland waters. Turkish Journal of Zoology, 40(1):87-102.

Teimori, A., Mostefavi, H. and Maleki, S. 2017. Investigating environmental variables on distribution of *Capoeta fusca* Nikolskii, 1897 in Iran. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 765-770. In Farsi.

Teimori, A., Motamedi, M. and Askari Hesni, M. 2017. Translocation and new geographical distribution of the invasive Redbelly Tilapia, *Coptodon zillii* (Gervais, 1848) (Teleostei: Cichlidae) in southern Iran. Check List, 13(1):2051.

Teimouri, B., Safaeian, S., Nabavi, S. M. B. and Khatami, S. H. 2011. Determination of PCB levels in fishes (*Cyprinus carpio* and *Esox lucius*) in Anzali Wetland. Journal of Marine Science and Technology Research, 5(4):45-53. In Farsi.

Teimouri, B., Safaeian, S. and Nabavi Seyed, M. B. 2011. Comparison of PCBs concentration in skin and mussel (*sic*) tissues of *Esox lucius* & *Cyprinus carpio* with PCBs concentration in Anzali Wetland (Abkenar) in autumn and winter 2009-2010. Journal of Animal Environment, 3(2):25-32. In Farsi.

Tejar, S., Khodadadi, M. and Javaheri, M. 2016. Comparison of efficacy of 2-phenoxyethanol, clove oil and PI222 as anesthetics on the plasma cortisol and glucose hormone in silver carp (*Hypophthalmichthys molitrix*). Journal of Aquaculture Development, 10(1):11-22. In Farsi.

Tekeh, Sh. and Imanpour, M. R. 2009. Effects of secondary sexual characteristics on biological characters of seminal fluid in mahisefid (*Rutilus frisii kutum* Kamensky 1901). Pajouhesh va Sazandegi, 21(4)(81 in Animal and Fisheries Sciences):8-15. In Farsi.

Tekmedash, F. S., Hemmatzadeh, M. and Khara, H. 2016. Stress indices of grass carp, *Cetenopharyngodon idella*, (Cuvier and Valenciennes, 1884) (*sic*) change in response to Monogenean parasites pollution, *Gyrodactylus* spp. and *Dactylogyrus* spp. Journal of Parasitic Diseases, 40(3):1044-1046.

Tekrival, K. L. and Rao, A. A. 1999. Ornamental and Aquarium Fish of India. Kingdon Books, Waterlooville, England. 144 pp.

Thesiger, W. 1985. Marsh Arabs. Collins, London. 2nd Revised Edition, 236 pp.

Thinès, G. 1969. L'évolution régressive des poissons cavernicoles et abyssaux. Masson et Cie, Paris. 394 pp.

Thinès, G. 1978. The blind fishes of Persia. Nature, London, 271(5640):305.

Thomas, H., Sen, S., Khan, M., Battail, B. and Ligabue, G. 1982. The Lower Miocene fauna of Al-Sarrar (Eastern province, Saudi Arabia). ATLAL, Journal of Saudi Arabian

Archaeology, 5(III):109-136, pls. 116-117.
Tilak, R. 1987. The Fauna of India and the Adjacent Countries. Pisces (Teleostomi). Sub-Family: Schizothoracinae. Zoological Survey of India, Calcutta. x + 229 pp.
Tilak, R. and Sinha, N. K. 1975. A study of the fishes of the subfamily Schizothoracinae (Pisces, Cyprinidae). I. On the generic status of Schizothorax Heckel, 1838. Annales Zoologici, Warszawa, 32(13):289-297.
Tilami, S. K., Ramezanpour, Z., Namin, J. I., Sattari, M., Dehkordi, S. K. and Sampels, S. 2016. Histological and enzymatic changes in liver of *Rutilus frisii kutum* fry in short term exposure to *Nodularia spumigena*. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).
Timur, M., Çolak, A. and Marufi, M. 1983. Balıklı Kaplıcadki (Sivas) Balık Türlerinin Tanımı ve Deri Hastalıı Tedavisindeki Etkisinin Araştırılması [A study on the systematic identification of the Balıklı thermal spring (Sivas) fish and the curative effects of the fish on dermal diseases]. Ankara Üniversitesi Veteriner Fakültesi Dergisi, 30(2):276-282.
Tipper, G. H. 1921. The geology and mineral resources of eastern Persia. Records of the Geological Survey of India, 53(1):51-80, pl. 4-11.
Tizkar, B. 2005. An introduction to Ichthyology Museum of Mirza Koochak Khan Training Centre. Second Conference on Natural History Museum in Iran, Ferdowsi University of Mashhad, p. 44 (abstract).
Tizkar, B., Bahmani, M., Hosseinzadeh Sahafi, H., Zoghi Shalmani, A., Zahmatkesh, A. and Monsef Kasmaei, H. 2019. The effects of dietary astaxanthin on the physiological, growth and survival of gold fish larvae (*Carassius auratus*). Journal of Aquaculture Development, 13(2):29-50. In Farsi.
Tolouei Nia, B., Aghamaali, M. R., Asoodeh, A. and Mehregan, M. 2019. Biochemical characterization of lysozyme extracted from Caspian kutum, *Rutilus kutum*, Kamensky 1901. Caspian Journal of Environmental Sciences, 17(3):271-280.
Toosi, A., Shajiee, H., Ghelichi, A. and Saberi, S. E. 2012. Evaluation of water quality in six springs northern Damghan based on the variety of macrobenthoses. New Technologies in Aquaculture Development (Journal of Fisheries), 5(4):49-60. In Farsi.
Torabi, M., Ghaemi Bafghi, M., Baghi, L., Arian, A., Rouhani Nezhad, M., Rashtibaf, M. and Darban Maghami, N. 2016. Developing of koi herpes viral disease (KHVD) PCR test in carp fishes. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Torabi Haghighi, A., Keshtkaran, P. and Klove, B. 2012. The effects of hydraulic construction on Kor River mesohabitat alteration in Iran. International Conference, Water Resources and Wetlands, Tulcea, Romania, 14-16 September 2012 (abstract).
Tork Haram Abadi, B., Bahalekeh, A., Eiri, B., Azimi Galougahi, H. A. and Pourrashid, H. 2021. Comparative study of growth patterns *Alburnoides namaki* Bogutskaya and Coad, 2009 in the Salt Lake Basin. Journal of Applied Ichthyological Research, 8 (3):52-62. In Farsi.
Tortonese, E. 1934. Pesci della Persia raccolti dal Marchese Giacomo Doria (1862). Bollettino dei Museo di Zoologia e di Anatomia Comparata della R. Università di Torino, 44, III(49):153-171, tav. 1.
Tortonese, E. 1937-1938a. Viaggio del dott. Enrico Festa in Palestina e in Siria (1893). Bollettino dei Musei di Zoologia e di Anatomia Comparata della R. Università de Torino, 46, III(85):1-48, tav. I-II.

Tortonese, E. 1937-1938b. Note di Ittiologia. III. Note sui Ciprinidi. Bollettino dei Musei di Zoologia e di Anatomia Comparata della R. Università de Torino, 46, III(74):81-85.

Tortonese, E. 1940. Elenco dei tipi esistenti nella collezione ittiologica del R. Museo di Torino. Bollettino dei Musei di Zoologia e di Anatomia Comparata della R. Università de Torino, 48, III(111):133-144.

Tortonese, E. 1961. Catalogo dei tipe di pesci del Museo Civico di Storia Naturale di Genova (Parte I). Annali del Museo Civico di Storia Naturale "Giacomo Doria", Genova, 72:179-191.

Tortonese, E. 1973. The ichthyological collections now existing in Italy. Annali del Museo Civico di Storia Naturale di Genova, 79:108-116.

Touchaei Sahel, P. 2013. Survey of heavy metals (Ni, Pb, Cu and Zn) accumulation in muscles, kidney, gill and scales of *Hypophthalmichthys molitrix* of Sistan, Chahnimeh. Journal of Oceanography, 4(13):21-28. In Farsi.

Touraji, M. R. and Vosoughi, Gh. 2006. Identification and study of fish species in Mazdaghan River. Pajouhesh va Sazandegi, 19(3)(72):19-29. In Farsi.

Tourchi-Moghaddam, M. 2003. An investigation on feeding habitats of *Hemiculter leucisculus* in the Anzali lagoon. M.Sc. Thesis, Higher Education Institute of Mirza-Kouchakhan, Rasht. 137 pp. In Farsi.

Travis, J. 1993. Invader threatens Black, Azov seas. Science, 262(5138):1366-1367.

Trewavas, E. 1972. The type-species of the genera *Phoxinellus*, *Pseudophoxinus* and *Paraphoxinus* (Pisces, Cyprinidae). Bulletin of the British Museum (Natural History) Zoology, 21(8):359-361.

Troll, C. 1963. Qanat-Bewässerung in der Alten und Neuen Welt. Mitteilungen der Österreichischen Geographischen Gesellschaft Wien, 105(3):313-330, 6 figs.

Tsepkin, E. A. 1986. Brief review of the freshwater Quaternary ichthyofauna of the Asian part of the USSR. Journal of Ichthyology, 26(3):110-116.

Tsigenopoulos, C. S. 1999. Phylogéographie du genre (Téléostéens, Cyprinidae) dans les régions péri-méditerranéennes. Reconstitution des grandes lignées de migration au moyen des marqueurs nucléaires et mitochondriaux. Thèse de Doctorat en Biologie des Populations et Ecologie, Université Montpellier, Montpellier. 190 pp.

Tsigenopoulos, C. S. and Berrebi, P. 2000. Molecular phylogeny of North Mediterranean freshwater barbs (genus *Barbus*: Cyprinidae) inferred from cytochrome b sequences: biogeographic and systematic implications. Molecular Phylogenetics and Evolution, 14(2):165-179.

Tsigenopoulos, C. S., Durand, J. D., Ünlü, E. and Berrebi, P. 2003. Rapid radiation of the Mediterranean *Luciobarbus* species (Cyprinidae) after the Messinian salinity crisis of the Mediterranean Sea, inferred from mitochondrial phylogenetic analysis. Biological Journal of the Linnean Society, 80(2):207-222.

Tsigenopoulos, C. S., Kasapidis, P. and Berrebi, P. 2010. Phylogenetic relationships of hexaploid large-sized barbs (genus *Labeobarbus*, Cyprinidae) based on mtDNA data. Molecular Phylogenetics and Evolution, 56(2):851-856.

Tulaby Dezfuly, Z., Aramoon, A., Alishahi, M., Halimi, M. and Rahnama, R. 2020. The effects of lead toxicity on the hematological parameters common carp (*Cyprinus Carpio*) at varying salinity levels. Iranian Journal of Toxicology, 14(1):1-8.

Turan, C. 2008. Molecular systematics of the *Capoeta* (Cypriniformes: Cyprinidae) species complex inferred from mitochondrial 16S rDNA sequence data. Acta Zoologica

Cracoviensia, 51A(1-2):1-14.
Turan, D., Bektaş, Y., Kaya, C. and Bayçelebi, E. 2016. *Alburnoides diclensis* (Actinopterygii: Cyprinidae), a new species of cyprinid fish from the upper Tigris River, Turkey. Zootaxa, 4067(1):79-87.
Turan, D., Ekmekçi, F. G., Kaya, C. and Güçlü, S. S. 2013. *Alburnoides anyasensis* (Actinopterygii, Cyprinidae), a new species of cyprinid fish from Manyas Lake basin, Turkey. ZooKeys, 276:85-102.
Turan, D., Kalayci, G., Kaya, C., Bektaş, Y. and Küçük, F. 2018. A new species of *Petroleuciscus* (Teleostei: Cyprinidae) from the Büyük Menderes River, southwestern Anatolia, Turkey. Journal of Fish Biology, 92(4):873-887.
Turan, D., Kottelat, M. and Bayçelebi, E. 2017. *Squalius semae*, a new species of chub from the Euphrates River, Eastern Anatolia (Teleostei: Cyprinidae). Zoology in the Middle East, 63(1):33-42.
Turan, D., Kottelat, M. and Doğan, E. 2013. Two new species of *Squalius*, *S. adanaensis* and *S. seyhanensis* (Teleostei: Cyprinidae), from the Seyhan River in Turkey. Zootaxa, 3637(3):308-324.
Turan, D., Kottelat, M., Gülsün Kırankaya, Ş. and Engin, S. 2006. *Capoeta ekmekciae,* a new species of cyprinid fish from northwestern Anatolia (Teleostei: Cyprinidae). Ichthyological Exploration of Freshwaters, 17(2):147-156.
Turan, D., Tomovic, L. and Pešić, V. 2007. Morphological variation in a common Turkish cyprinid, *Squalius cephalus*, across Turkish water catchment areas. Zoology in the Middle East, 40(1):63-70.
Turan, D., Yilmaz, B. T. and Kaya, C. 2009. *Squalius kottelati*, a new cyprinid species (Teleostei: Cyprinidae) from Orontes River, Turkey. Zootaxa, 2270(1):53-62.
Türkmen, M. and Akyurt, I. 2000. Karasu İmağı'n ın Aşkale Mevkiinden Yakalanan Gümüş Balığı *Chalcalburnus mossullensis*, (*sic*) Heckel, 1843)'nın Populasyon Yapısı ve Büyüme Özellikleri [The population structure and growth properties of *Chalcalburnus mossulensis* (Heckel, 1843) caught from Aşkale region of River Karasu]. Turkish Journal of Biology, 24(1):95-111.
Türkmen, M., Erdoğan, O., Haliloğlu, H. I. and Yildirim, A. 2001. Age, growth and reproduction of *Acanthalburnus microlepis* Filippi 1863 from the Yağan Region of the Aras River, Turkey. Turkish Journal of Zoology, 25(2):127-133.
Türkmen, M., Erdoğan, O., Yildirim, A. and Akyurt, I. 2002. Reproduction tactics, age and growth of *Capoeta capoeta umbla* Heckel, 1843 from the Aşkale Region of the Karasu River. Fisheries Research Journal, 54(3):317-328.
Türkmen, M., Haliloğlu, H. I., Erdoğan, O. and Yıldırım, A. 1999. The growth and reproduction characteristics of chub *Leuciscus cephalus orientalis* (Nordmann, 1840) living in the River Aras. Turkish Journal of Zoology, 23(4):355-364.
Turnbull, P. F. and Reed, C. A. 1974. The fauna from the Terminal Pleistocene of Palegawra Cave, a Zarzian occupation site in northeastern Iraq. Fieldiana Anthropology, 63(3):81-146.

U

Ündar, L., Akpinar, M. A. and Yanikoğlu, A. 1990. "Doctor fish" and psoriasis. The Lancet, 335:470-471.

UNDP and FAO. 1998. Fish for Life. Creating sustainable livelihoods. UNDP (United Nations Development Programme) and FAO (Food and Agriculture Organisation) working in the Islamic Republic of Iran with collaboration of Fisheries Organisations of Iran. UNDP, Tehran. In English and Farsi.

UN-ESCWA and BGR (United Nations Economic and Social Commission for Western Asia; Bundesanstalt für Geowissenschaften und Rohstoffe). 2013. Inventory of Shared Water Resources in Western Asia. Beirut. xiii + 606 pp.

UNEP. 2003. Afghanistan. Post-Conflict Environmental Assessment. United Nations Environmental Programme, Switzerland. 176 pp.

United Nations. 2001. United Nations Inter-agency Assessment Report on the Extreme Drought in the Islamic Republic of Iran. Islamic Republic of Iran. ii + 24 pp.

Ünlü, E. 1991. Dicle Nehrinde Yaşayan *Capoeta trutta* (Heckel, 1843)'nin Biyolojik Özellikleri Üzerinde Çalişmalar [Studies on the biological characteristics of *Capoeta trutta* (Heckel, 1843) living in Tigris River]. Doğa Türk Zooloji Dergisi, 15(1):22-38.

Ünlü, E. 2006. Tigris River ichthyological studies in Turkey. A review with regard to the Ilisu Hydroelectric Project. Environmental Impact Assessment Report, Ilisu Environment Group, Hydro Concepts Engineering, Hydro Québec International, Archéotec Inc. 34 pp.

Ünlü, E. and Balcı, K. 1993a. A study on the reproductive characteristics of *Leuciscus cephalus orientalis* (Nordmann, 1840) from the Savur Stream. Doğa Türk Zooloji Dergisi, 17(1):91-102.

Ünlü, E. and Balci, K. 1993b. Observation on the reproduction of *Leuciscus cephalus orientalis* (Cyprinidae) in Savur Stream (Turkey). Cybium, 17(3):241-250.

Ünlü, E., Balcı, K. and Akbayin, H. 1994. Some biological characteristics of the *Acanthobrama marmid* Heckel, 1843 in the Tigris River (Turkey). Turkish Journal of Zoology, 18(2):131-139.

Ünlü, E., Kilic-Demirok, N., Cengiz, E. I. and Karadede, H. 1997. Karyology of *Garra rufa* (Cyprinidae) in River Tigris (Turkey). Ninth International Congress of European Ichthyologists (CEI9) "Fish Biodiversity". Italy 1997 (Napoli-Trieste). Book of Abstracts, p. 95.

Ünver, B. and Erk'akan, F. 2005. A natural hybrid of *Leuciscus cephalus* (L.) and *Chalcalburnus chalcoides* (Güldenstädt) (Osteichthyes-Cyprinidae) from Lake Tödürge (Sivas, Turkey). Journal of Fish Biology, 66(4):899-910.

Ünver, B., Tatlidil, H. and Erka'akan, F. 2008. Biometrical features of intergeneric hybrid between *Leuciscus cephalus* (L.) and *Chalcalburnus chalcoides* (G.) (Osteichthyes-Cyprinidae) distributed in Lake Tödürge (Sivas-Turkey). Turkish Journal of Fisheries and Aquatic Sciences, 8(2):207-213.

Urdu, S. and Owfi, F. 2012. Environmental analysis of the International Wetland of Parishan on the basis of the SWOT Management Model. Journal of Animal Biology, 5(1):1-9. In Farsi.

U.S. Fish and Wildlife Service. 2018. Bighead carp (*Hypophthalmichthys nobilis*). Ecological risk screening summary. U.S. Fish and Wildlife Service, www.fws.gov/fisheries/ans/erss/highrisk/ERSS-Hypophthalmichthys-nobilis-FINAL-August2018.pdf.

Usmanova, R. G. 1971. Sexual dimorphism and age-related and local variation of the Turkestan barbel [Barbus capito *conocephalus* (Kessler)] of the Kashkadar'ya River basin. Journal of Ichthyology, 11(2):164-174.

Usmanova, R. G. 1975. Ecological variability of the "Turkestan gudgeon" (Gobio gobio lepidolaemus) of the Kashkadar'ya basin. Journal of Ichthyology, 15(5):724-729.

V

Vaezzadeh, V., Mashinchian Moradi, A., Esmaeili Sari, A. and Fatemi, S. M. R. 2008. Study of organochlorine pesticides in muscle tissue of two commercial fish species (*Cyprinus carpio* and *Rutilus frisii kutum*) in southwest of Caspian Sea. Environmental Sciences, 5(3):33-40.

Vafadarnejad, M., Gharaei, A., Mirdar Harijani, J. and Miri, M. 2018. Determining of copper oxide nanoparticles (CuO NPs) LC50 in grass carp (*Ctenopharyngodon idella*) and its effects on hematological and liver enzymes activity indices. Journal of Fisheries (Iranian Journal of Natural Resources), 71(1):11-21. In Farsi.

Vaghefi, H. R. S., Hajiali, A. and Shaybani, F. 2012. Water quality assessment of Taleghan River. Life Science Journal, 9(4):480-484.

Vahabnezhad, A. 2017. Marine food web dynamics of small-sized pelagic fish in the Caspian Sea (Iranian's water). Iranian Fisheries Science Research Institute, Tehran. 74 pp. In Farsi.

Vahabzade Rodesari, H. 2003. Evaluate the efficiency of hydrogen peroxide and levaemisole hydrochloride in the treatment of Persian sturgeon, Chinese carp eggs and juveniles. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 112 pp. In Farsi.

Vahabzadeh Roodsari, H., Ahmadi, M. R., Keyvan, A., Masumian, M. and Monajemi, B. 2003. Comparison of hydrogen peroxide and malachite green efficacy to control fungal infection in carp, *Cyprinus carpio*, artificial propagation. Iranian Journal of Marine Sciences, 2(1):77-86. In Farsi.

Vahedi, M., Zamini, A. and Vahabzadeh, H. 2015. Antibacterial effect of *Oriyganum vulgare* essence on skin and gill tissue and some immunity indices of *Ctenopharyngodon idella*. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, pp. 109-110.

Vahedi, Z. and Pazooki, J. 2017. Lesions caused by monogenean parasites on gill tissue and chloride cells of Caspian Sea white fish. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 30(1):163-172. In Farsi.

Vahid Farabi, S. M., Behrozi, Sh., Ghanei, M., Azari, A. H. and Sharifian, M. 2013. The survey effect of salinity and turbidity performed on survival rate and histological changes in gill tissues of *Rutilus frisii kutum* juveniles (<1g). Journal of Fisheries, 7(3):73-84. In Farsi.

Vahid Farabi, S. M., Hedayatifard, M., Behrouzi, S. H. and Sharifian, M. 2013. The determination of *Rutilus frisii kutum* (< 1000 mg) resistance to salinity and turbidity. Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).

Vahid Farabi, S. M., Nasrollahzadeh Saravi, H., Fazli, H. and Ghaneei Tehrani, M. 2017. Feasibility study for the introduction of fish for cage culture in the southern part of Caspian Sea. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 625-631. In Farsi.

Vahidi, I. 1963. Groundwater investigations in Iran, pp. 107-109. In: The Development of Groundwater Resources with Special Reference to Deltaic Areas (Transactions of the

Regional Seminar on the Development of Groundwater Resources with Special Reference to Deltaic Areas, held at Bangkok, Thailand, from 24 April to 8 May 1962). United Nations Economic Commission for Asia and the Far East, New York.

Vaisi, A. and Pejmanmehr, P. 2014. Uba gene application for parentage assignment in Iranian wild common carp (*Cyprinus carpio*). Advances in Environmental Biology, 8(7):3183-3185.

Vajargah, M. F., Gerami, M. H., Sattari, M. and Hedayati, A. 2020. Morphological analysis of *Alburnoides samiii* from Toolkhone River, Guilan Province, south Caspian Sea basin. Iranian Journal of Fisheries Sciences, 19(2):1015-1023.

Vajargah, M. F. and Hedayati, A. 2014. The effect of preservation in formalin on the morphological characters of spirlin (*Alburnoides Eichwaldii*) (*sic*). Journal of Environmental Treatment Techniques, 2(3):106-108.

Vajargah, M. F. and Hedayati, A. 2015. Morphological variations of common carp (*Cyprinus carpio*) by fixation and preservation in 10% formalin. Journal of Coastal Life Medicine, 3(7):518-519.

Vajargah, M. F., Hossaini, S. A. and Hedayati, A. 2013. Acute toxicity test of two pesticides diazinon and deltamethrin on spirlin (*Alburnoides bipunctatus*) larvae and fingerling. Journal of Toxicology and Environmental Health Sciences, 5(6):106-110.

Vajargah, M. F., Hossaini, S. A., Niazie, E. H. N., Hedayati, A. and Vesaghi, M. J. 2013. Acute toxicity of two pesticides diazinon and deltamethrin on tench (*Tinca tinca*) larvae and fingerlings. International Journal of Aquatic Biology, 1(3):138-142.

Vajargah, M. F., Yalsuyi, A. M. and Hedayati, A. 2018. Effects of dietary kemin multi-enzyme on survival rate of common carp (*Cyprinus carpio*) exposed to abamectin. Iranian Journal of Fisheries Sciences, 17(3):564-572.

Vakili, A. 1995. An overview of water resources development in Iran. WRM ‘95. Proceedings of the Regional Conference on Water Resources Management, Conference Secretariat, Isfahan University of Technology, Isfahan, pp. 1-2.

Vakili, S., Eidi, M. and Ashja Ardalan, A. 2020. Evaluation of some commercial fish species otoliths in Fereydunkenar’s water. Journal of Animal Environment, 12(3):115-166. In Farsi.

Valeipour, A. and Haghighy, D. 2000. Study on changes in fishing in Anzali Lagoon (1992-1996). Iranian Scientific Fisheries Journal, 8(4):73-88, 7. In Farsi.

Valeolahy, J. 2000. Uniquely significant fresh water fishes of Iran are exposed to environmental stress. Journal of Environmental Studies, 26(25):29-38. In Farsi.

Vali Elahi, J. 2010. Comparison of two subspecies of *Barbus capito* in southern parts of Caspian Sea basin. Journal of Taxonomy and Biosystematics, 2(2)(3):67-77.

Valiallahi, J. 2000. A revision of *Barbus* species of Iran (Cypriniformes: Cyprinidae). Ph.D. Thesis, Faculty of Natural Resources, University of Tarbiat Modares, Tehran. 200 pp. In Farsi.

Valiallahi, J. 2002. Final Report of Research Plan: An effort for identifying of *Barbus* species of Talar River, Zirab, Golestan. First phase. Shahid Beheshti University, Tehran. In Farsi.

Valiallahi J. 2004. Habitats, distribution and notes on *Barbus mystaceus* and *Barbus barbulus*, the two Barbus species of Iran. Journal of Environmental Studies, 29(32):27-34, 4. In Farsi.

Valiallahi, J. 2006. Identification of *Barbus plebejus* (Bonaparte, 1832) a valid species of cyprinid fish from Iran. Iranian Journal of Biology, 19(1):109-116. In Farsi.

Valiallahi, J. 2015. Identifying and taxonomic comparing of *Barbus miliaris* Filippi, 1862, a valid species of cyprinid fish in Iran. Journal of Applied Ichthyology Research, 2(4):83-94. In Farsi.

Valiallahi, J. 2017a. Threatened fishes of the world: *Luciobarbus barbulus* (Heckel, 1849) (Cyprinidae) one of the Zagros giant, *Barbus* of Persia. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 836-841. In Farsi.

Valiallahi, J. 2017b. Threatened fishes of the world: *Arabibarbus grypus* (Heckel, 1843) (Cyprinidae) new record on status and range distribution. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 868-879. In English.

Valiallahi, J. 2018. Any action to authorize the entry, expansion, and development of Tilapia fish farming in Iran waters is a serious threat to the country’s biodiversity and the destruction of Iranian Barbus stocks. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Valiallahi, J. 2020. Range map and distribution of *Luciobarbus barbulus* Heckel 1847 in the Tigris and Euphrates river basins. Transylvanian Review of Systematical and Ecological Research, 22(1):57-68.

Valiallahi, J., Pourabasali, M., Janalizadeh, E. and Bucio, A. 2018. Use of *Lactobacillus* for improved growth and enhanced biochemical, hematological, and digestive enzyme activity in common carp at Mazandaran, Iran. North American Journal of Aquaculture, 80(2):206-215.

Valiallahi, J. and Sadghi Zadeh, M. 2000. Evaluating RAPD markers for species-level analysing of some of Iranian large *Barbus* spp. Laboratory of Genetic National Research Center for Genetic Engineering and Biotechnology, Tarbiat Modares University, Tehran. In Farsi.

Valiallahi, J., Shahmahmodi, S., Bidel, R., Haidary, B., Ghazi, M. and Jaliliyan, M. 1998. The fishes of three major river of Kermanshah Province (Gamasiab, Gharaso, Razavar). Final Report of Research Plan, Kermanshah Fishery Research of Natural Resources and Animal Husbandry, Kermanshah. 65 pp. In Farsi.

Valid, H. and Tigranian, E. A. 1977. Inland water fishes of Iraq. Short key to the species and their characteristics. Manuscript, Inland Water Fisheries Institute, Baghdad. 89 pp. In Russian.

Valikhani, H., Aazami, J., Abdoli. A., Nejat, F., Shahinpur, A. and Khezri, K. 2020. Length-weight relationship and condition factor of fish species in shallow freshwater habitats from Khuzestan Province, Iran. Journal of Wildlife and Biodiversity, 4(2):13-21.

Valikhani, H., Abdoli, A., Hassanzadeh Kiabi, B., Nejat, F., Sadeghsaba, M. and Khosravi, M. 2018. A study on the status of invasive tilapia species (*Coptodon zillii* Gervais, 1848 and *Oreochromis aureus* Steindachner, 1864) in aquatic ecosystems of Khuzestan Province, Iran. Environmental Sciences, 15(4):29-44. In Farsi.

Vali-ollahi, J. 2019. Notes on taxonomy of *Barbus kotschyi* (Heckel, 1843) and *Barbus grypus* Heckel, 1843. Journal of Experimental Animal Biology, 7(4):91-98. In Farsi.

Valipour, A., Fallahi, M., Behmanesh, Sh., Zahmatkesh, A., Hosseinjani, A., Dadgar, Sh., Vaezi, M., Tizro, S., Hajizadeh, A., Khedmati, K., Mohammadzadeh, S., Ahmadi, H., Moshapor, H., Safarzadeh, N. and Ramin, M. 2017. Aquaculture potentials investigation of Yamchi Dam down stream areas in Ardabil Province, Tehran, Iran. Iranian Fisheries Research Institute. 49 pp. In Farsi.

Valipour, A., Hamedi, N. and Abdollahpour, H. 2013. The effect of probiotic *Pediococcus acidilactici* supplementation on blood parameters of fingerlings kutum *Rutilus kutum.* Aquaculture Europe 2013, 10-12 August, Making Sense of Science, Trondheim, Norway (abstract).
Valipour, A. and Heidari, B. 2021a. Response of sex hormones of Caspian kutum (*Rutilus kutum*) in contrast to injection of different concentrations of the kisspeptin neuropeptide. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.
Valipour, A. and Heidari, B. 2021b. Reproductive performance of goldfish (*Carassius auratus*) after injection of different kisspeptin neuropeptides. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021. 7 pp. In Farsi.
Valipour A., Kanipour, A., KhadiviNia Moghaddam, M. and Valinassab, T. 2011. Kutum: jewel of the Caspian Sea. Iranian Fisheries Research Organization, Tehran.
Valipour A. and Khanipour A. A. 2009. Kutum, *Rutilus frisii kutum*, The Jewel of the Caspian Sea. Iranian Fisheries Research Organisation and Caspian Environment Program (CEP) (www.caspianenvironment.org). 95 pp.
Valipour, A. and Maghsoodieh Kohan, H. 2018. The study of stocking density effect on growth and survival of fingerlings kutum, *Rutilus kutum*, with Caspian Sea water. Journal of Applied Ichthyological Research, 6(1):131-144. In Farsi.
Valipour, A. R. 2004. An investigation of *Capoeta capoeta* feeding in Makoo Dam Lake. Iranian Scientific Fisheries Journal, 13(2):163-176. In Farsi.
Valipour, A. R. 2010. Artificial propagation and culture of Rutilus frisii kutum of autumn form for restocking. Iranian Fisheries Science Research Institute, Tehran. 79 pp. In Farsi.
Valipour, A. R. 2016, The study of rearing density effect on growth and survival of fingerlings kutum, *Rutilus kutum*, with Caspian Sea water. Iranian Fisheries Science Research Institute, Tehran. 28 pp. In Farsi.
Valipour, A. R. and Khanipour, A. A. 2015. Bionormative determination of artificial reproduction of autumn form of Caspian Sea kutum, *Rutilus frisii*. Journal of Aquaculture Development, 9(4):75-88. In Farsi.
Valipour, A. R., Shahraki N., H. and Abdollahpour Biria, H. 2018. Effects of probiotic (*Pediococcus acidilactici*) on growth and survival of kutum (*Rutilus kutum*) fingerlings. Iranian Journal of Fisheries Sciences, 17(1):35-46.
Valipour, S., Mesbah, M., Javaheri Baboli, M. and Alishahi, M. 2014. Effects of dietary ethanolic extract of propolis, a honeybee product, on immune parameters of common carp (*Cyprinus carpio*). Journal of Fisheries, 7(4):17-26. In Farsi.
Valizade, A., Sattari, M., Mousavi-Sabet, H., Nasrollazade, A. and Ahmadnezhad, M. 2016. Sexual dimorphism in bitterling, *Rhodeus amarus*, Bloch, 1782, from Siahdarvishan River. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).
Van Baak, C. G. C., Grothe, A., Richards, K., Stoica, M., Aliyeva, E., Davies, G. R., Kuiper, K. F. and Krijgsman, W. 2019. Flooding of the Caspian Sea at the intensification of northern Hemisphere glaciations. Global and Planetary Change, 174:153-163.
van Beek, E., Bozorgy, B., Vekerdy, Z. and Meijer, K. 2008. Limits to agricultural growth in

the Sistan Closed Inland Delta, Iran. Irrigation and Drainage Systems, 22(2):131-143.
van Buren, E. D. 1948. Fish-offerings in ancient Mesopotamia. Iraq, 10(2):101-121.
Van Damme, D., Bogutskaya, N., Hoffman, R. C. and Smith, C. 2007. The introduction of the European bitterling (*Rhodeus amarus*) to west and central Europe. Fish and Fisheries, 8(2):79-106.
van den Eelaart, A. 1954. Report to the Government of Iraq on the Development of Inland Fisheries. Food and Agriculture Organization, Rome, Report of the Expanded Technical Assistance Program, 270:42 pp.
van der Laan, R., Eschmeyer, W. N. and Fricke, R. 2014. Family-group names of Recent fishes. Zootaxa, 3882(2):1-230.
van der Leeden, F. (Ed.). 1975. Water Resources of the World. Selected Statistics. Water Information Center, Port Washington, New York. xi + 568 pp.
van Zeist, W. 1967. Late Quaternary vegetation history of western Iran. Review of Palaeobotany and Palynology, 2(1-4):301-311.
van Zeist, W. and Bottema, S. 1977. Palynological investigations in western Iran. Palaeohistoria: Acta et Communicationes, 19:19-85.
van Zeist, W. and Bottema, S. 1982. Reflections on a Holocene subdivision of the Near East. Striae, Uppsala, 16:36-39.
van Zeist, W. and Woldring, H. 1978. A postglacial pollen diagram from Lake Van in east Anatolia. Review of Palaeobotany and Palynology, 26(1-4):249-276.
van Zeist, W. and Wright, H. E. 1963. Preliminary pollen studies at Lake Zeribar, Zagros Mountains, southwestern Iran. Science, 140(3562):65-67.
Varasteh, G., Soltani, M., Shamsaee Mehrjan, M. and Kamali, A. 2018. Investigation of changes in growth indices, immune factors and hepatic enzymes of koi carp (*Cyprinus carpio carpio*) in an aquaponic system. Journal of Wetland Ecobiology, 10(3):75-90. In Farsi.
Varedi, S. E. and Fazli, H. 2005. Analyzing water quality in Mazandaran Province rivers during release of fish fingerlings. Iranian Scientific Fisheries Journal, 14(3):167-182. In Farsi.
Varedi, S. E., Vahedi, F., Oloomi, Y., Younesi Pour, H. and Nasrolatabar, A. 2007. A survey of three trout farms phosphorus loading into Haraz River, north Iran. Iranian Scientific Fisheries Journal, 16(1):151-160. In Farsi.
Various Authors. 2000. History of qanats (aqueducts). Barzegar, Tehran, 819:54-63. In Farsi (English translation at www.netiran.com/Htdocs/Clippings/Social/200629XXSO01.html, downloaded 15 December 2000).
Varkouhi, S. 2009. Lead in Sarbaz River basin sediments, Sistan and Baluchestan, Iran. Integrated Environmental Assessment Management, 5(2):320-330.
Varkouhi, Sh. 2007. Biogeochemical evaluation of trace elements in fish liver case study: Khorramabad River basin, Lorestan, Iran. Iranian Journal of Science and Technology, Transaction A, 31(A1):53-61.
Varkouhi, Sh. and Sobhani, E. A. 2005. The study of environmental biogeochemistry of trace elements in fishes of Khorramabad River watershed. Journal of Environmental Science and Technology, 7(1)(24):55-64. In Farsi.
Varnosfaderany, M. N., Ebrahimi, E., Mirghaffary, N. and Safyanian, A. 2010. Biological assessment of the Zayandeh Rud River, Iran, using benthic macroinvertebrates. Limnologica, 40(3):226-232.

Varzani, M., Vatandoust, S. and Alavi-Yeganeh, M. S. 2017. Some biological features of *Alburnoides namaki* in Qara-Chai and Mazlaqan-Chai. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Vasil'eva, E. D. and Vasil'ev, V. P. 2000. The origin and taxonomic status of the triploid form of the goldfish, *Carassius auratus* (Cyprinidae). Journal of Ichthyology, 40(8):553-563.

Vasil'eva, E. D., Vasil'ev, V. P. and Kuga, T. I. 2004. On taxonomy of gudgeons of the genus *Gobio* (Gobioninae, Cyprinidae) of Europe: a new gudgeon species *Gobio kubanicus* from the basin of the Kuban River. Journal of Ichthyology, 44(9):716-731.

Vasil'yeva, E. D. and Ustarbekov, A. K. 1991. Variability in the skull of the bream *Abramis brama* from the Caspian and Aral Sea basins. Journal of Ichthyology, 31(3):82-99.

Vatandoost, S., Peyvandi, N. and Gholizadeh, M. 2015. A biological study on reproduction of *Barbus lacerta* in Tajan River, northern Iran. New Technologies in Aquaculture Development (Journal of Fisheries), 9(2):15-24. In Farsi.

Vatandoust, S., Keshavarz Divkolaei, M. and Amani, K. 2010. Investigation on the biodiversity of fishes in wetlands in north of Iran. Journal of Wetland Ecobiology, 1(2):91-100. In Farsi.

Vatandoust, S., Mousavi-Sabet, H., Geiger, M. F. and Freyhof, J. 2019. A new record of Iranian subterranean fishes reveals the potential presence of a large freshwater aquifer in the Zagros Mountains. Journal of Applied Ichthyology, 35(6):1269-1275.

Vatandoust, S., Mousavi-Sabet, H. and Yerli, S. V. 2016. Exotic freshwater fishes of Iran. FABA 2016: International Symposium on Fisheries and Aquatic Science, 3-5 November 2016, Antalya, Turkey (abstract).

Vatandoust, S., Nejati, M., Anvarifar, H. and Mousavi-Sabet, H. 2014. Morphological differentiation of *Vimba persa* (Pisces: Cyprinidae) along the southern Caspian Sea Basin, Iran. European Journal of Zoological Research, 3(2):94-102.

Vatandoust, S., Yerli, S. V. and Jalili, P. 2016. Descriptive osteology of *Squalius orientalis* from Urmia Lake basin of Iran. International Journal of Aquatic Biology, 4(3):215-223.

Vatankhah, A., Sudagar, M., Dastar, B. and Kolangi, H. 2014. The effect of adding cow bile salts to the diet on the indices of growth, survival, carcass composition and some hematological and biochemical indices of blood serum of common carp (*Cyprinus carpio*). Journal of Animal Environment, 6(3):19-26. In Farsi.

Vaziriyan, M., Banaee, M., Nemadoost Haghi, B. and Mohiseni, M. 2018. Effects of dietary exposure to aflatoxins on some plasma biochemical indices of common carp (*Cyprinus carpio*). Iranian Journal of Fisheries Sciences, 17(3):487-502.

Vaziry, A. 2016. Immune response and changes in serum biochemical and enzymes of goldfish broodstock (*Carassius auratus gibelio*) injected with human chorionic gonadotropin (hCG). Journal of Fisheries Science and Technology, 5(2):45-58. In Farsi.

Vazirzadeh, A. 2015. A survey on the aquacultural potential of freshwater fish of Iran for diversification of aquaculture industry. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 193.

Vazirzadeh, A., Farhadi, A., Naseri, M. and Jeffs, A. 2016. Comparison of methods to improve induction of spermiation in wild-caught carp (*Cyprinus carpio carpio*), a threatened species from the Caspian Sea basin. Animal Reproduction Science, 170:100-107.

Vazirzadeh, A. and Fazilat, N. 2018. Effects of dimethoate pesticide and bacilar bio-fertilizer on some blood parameters of common carp (*Cyprinus carpio*). Journal of Applied Ichthyological Research, 6(4):71-84. In Farsi.

Vazirzadeh, A., Imani, A. and Naseri, M. 2015. Changes in plasma vitellogenin, phosphorus and calcium in wild-caught female carp (*Cyprinus carpio*) as potential criteria for selecting brood-fish for restocking natural populations. Iranian Journal of Science and Technology, Transaction A, 39(2):141-146.

Vazirzadeh, A., Mojazi Amiri, B. and Fostier, A. 2014. Ovarian development and related changes in steroid hormones in female wild common carp (*Cyprinus carpio carpio*), from the south-eastern Caspian Sea. Journal of Animal Physiology and Animal Nutrition, 98(6):1060-1067.

Vazirzadeh, A., Mojazi Amiri, B., Yelghi, S., Hajimoradloo, A., Nematollahi, M. A. and Mylonas, C. C. 2011. Comparison of the effects of different methods of mammalian and salmon GnRHa administration on spawning performance in wild-caught female carp (*Cyprinus carpio carpio*) from the Caspian Sea. Aquaculture, 320(1-2):123-128.

Vazirzadeh, A. and Yelghi, S. 2015. Long-term changes in the biological parameters of wild carp (*Cyprinus carpio carpio*) from the south-eastern Caspian Sea. Iranian Journal of Science and Technology, 39(A3)(Special Issue):391-397.

Vazirzadeh, A., Zahedinejad, S. and Bahri, A. 2015. Spawning induction in doctor fish, *Garra rufa* (Heckel, 1843) by ovaprim and captive rearing of larvae. Iranian Journal of Ichthyology, 1(4)(2014):258-265.

Veisi, R. S., Hedayati, S. A. R., Bagheri, T. and Nodeh, A. J. 2018. Study on hematological indices of common carp (*Cyprinus carpio*) exposed to iron nanoparticles and *Lactobacillus*. Journal of Animal Environment, 9(4):215-222. In Farsi.

Vekerdy, Z. and Dost, R. 2006. History of environmental change in the Sistan basin based on satellite image analysis: 1976-2005. United Nations Environment Programme, Nairobi. 56 pp.

Velayatzadeh, M. 2019. Measurement and comparison of selenium in some marine, freshwater and farmed fishes of Ahwaz market. Journal of Food Hygiene, 8(4):15-23. In Farsi.

Velayatzadeh, M. and Abdollahi, S. 2011. Study and comparison of Hg, Cd and Pb accumulation in the muscle and liver tissues of *Aspius vorax* in Karoon River, in winter season. Journal of Animal Environment, 2(4)(8):65-72. In Farsi.

Velayatzadeh, M. and Askary Sary, A. 2020. Health risk assessment of mercury in the edible tissues of some fish in southwest of Iran: A review. Zanko Journal of Medical Sciences, 21(68):11-24. In Farsi.

Velayatzadeh, M., Biria, M. and Bazyar, S. 2014. The study and comparison of some of chemical compositions in muscle of three endemic species of Cyprinidae from Hor-e-Lazim Wetland in Khoozestan Province. Journal of Animal Biology, 6(2):83-92. In Farsi.

Velayatzadeh, M., Biria, M. and Mohammadi, E. 2015. Determination of heavy metals (Hg, Cd, Pb and Cu) in *Carasobarbus luteus* in Karun River, Iran. World Journal of Fish and Marine Sciences, 7(3):158-163.

Velayatzadeh, M., Nildar, A. and Razavi, S. M. R. 2012. Effect of salt and deep freezing on drip and drip protein and TVB-N in four species fishes *Liza aurata*, *Esox lucius*, *Cyprinus carpio* and *Rutilus frisii kutum* from Caspian Sea. Journal of Aquatic Animals and Fisheries, 3(11):51-58. In Farsi.

Velayatzadeh, M. and Tabibzadeh, M. 2011. Comparing of heavy metals accumulation Hg, Cd and Pb in the muscle and liver of *Cyprinion macrostomus* (*sic*) in Karoon River. Innovation in Food Science and Technology (Journal of Food Science and Technology), 3(1)(7):27-33. In Farsi.

Verdipour, M., Eagderi, S. and Esfand Abad, B. S. 2016. Fish habitat use characteristics of *Barbus lacerta* (Heckel 1843) in Taleghan River (Sefid River basin). Journal of Animal Environment, 8(3):183-190. In Farsi.

Verigina, I. A. 1991. Ichthyological collections of the Zoological Museum of the Lomonosov Moscow State University (On the 200th Anniversary of the Zoological Museum of MSU). Journal of Ichthyology, 32(2):110-119.

Vesaghi, M. J., Khanipour, A., Sattari, M. and Forouhar Vajargah, M. 2016. Assessment of morphometric and meristic characteristics of *Garra rufa* fish in the Dinawar River, Kermanshah Province. Journal of Experimental Animal Biology, 5(2):82-96. In Farsi.

Vesey-Fitzgerald, B. and Lamonte, F. No date. Game Fish of the World. Harper & Brothers, New York. xvii + 446 pp.

Vesiland, P. J. 1993. The Middle East's water - critical resource. National Geographic, 183(5):38-71.

Vetlugina, T. A. 1992. The biology of tench, *Tinca tinca*, in the Volga Delta. Journal of Ichthyology, 32(5):58-64.

Vijayalakshmanan, M. A. 1950. A note on the fishes from the Helmund River in Afghanistan, with the description of a new loach. Records of the Indian Museum, 47(2):217-224.

Vilenkin, B. Ya., Chikatunov, V. I., Coad, B. W. and Schileyko, A. A. 2009. A random process may control the number of endemic species. Biologia, Bratislava, 64(1):107-112.

Vilizzi, L., Ekmekçi, F. G., Tarkan, A. S. and Jackson, Z. J. 2015. Growth of common carp *Cyprinus carpio* in Anatolia (Turkey), with a comparison to native and invasive areas worldwide. Ecology of Freshwater Fish, 24(2):165-180.

Vilizzi, L., Tarkan, A. S. and Copp, G. H. 2015. Experimental evidence from causal criteria analysis for the effects of common carp *Cyprinus carpio* on freshwater ecosystems: a global perspective. Reviews in Fisheries Science and Aquaculture, 23(3):253-290.

Visi, M., Alishahi, M. and Javaheri Baboli, M. 2017. Effect of aqueous extract of bee beetle on blood indexes (*sic*) of common carp (*Cyprinus carpio*). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, p. 385-391. In Farsi.

Vita-Finzi, C. 1978. Recent alluvial history in the catchment of the Arabo-Persian Gulf, pp. 255-261. In: Brice, W. C. (Ed.). The Environmental History of the Near and Middle East Since the Last Ice Age. Academic Press, London. xx + 384 pp.

Vladykov, V. D. 1962. Fisheries survey of Karadj Lake. MS, 9 pp.

Vladykov, V. D. 1964. Report to the Government of Iran on the inland fisheries, especially of the Caspian Sea with special reference to sturgeon. Food and Agriculture Organization, Rome, Report FAO/EPTA 1818:51 pp.

von den Driesch, A. and Dockner, A. 2002. Animal exploitation in medieval Siraf, Iran, based on the faunal remains from the excavations at the Great Mosque (seasons 1966-1973). Bonner Zoologische Beiträge, 50(3):227-247.

von Seidlitz, N. 1858. Rundreise um den Urmia-See in Persien, im Jahre 1856. Petermann's Geographische Mittheilungen, 4(6):227-236.

Voropaev, G. and Kosarev, A. 1982. The fall and rise of the Caspian Sea. New Scientist,

94(1300):78-80.
Voropaev, G. V., Krasnozhon, G. F. and Lahijani, K. K. 1998. River runoff and stability of the Iranian Caspian coast. Water Resources, 25(6):689-700.
Voropaev, G. V. and Velikanov, A. L. 1985. Partial southward diversion of northern and Siberian rivers, pp. 67-83. In: Golubev, G. N. and Biswas, A. K. (Eds.). 1985. Large Scale Water Transfers: Emerging Environmental and Social Experiences. Water Resources Series, 7:viii + 158 pp.
Vosoughi, A. A. R., Ghafari Khalaf Mohammadi, S. M. and Mohammadi Gholam, H. 2009. Study and comparison of some biological aspects of reproduction of two close barb species: *Barbus pectoralis* (Heckel, 1843) and *Barbus barbulus* (Heckel, 1849) in Karoon River. Journal of Marine Science and Technology Research, 4(1):67-79. In Farsi.
Voss, K. A., Famiglietti, J. S., Lo, M., de Linage, C., Rodell, M. and Swenson, S. C. 2013. Groundwater depletion in the Middle East from GRACE with implications for transboundary water management in the Tigris-Euphrates-Western Iran region. Water Resources Research, 49(2):904-914.
Vossughi, G. (= Wossughi, Gh.). 1985. The identification of freshwater fishes in the Dashti province of Bushehr. Fifth Congress of European Ichthyologists, Stockholm, 12-16 August 1985. p. 158 (abstract).
Vossoughi, G H. (= Wossughi, Gh.). 1998. On a collection of fresh water fishes from west of Jazmurian in southeastern Iran. Indian Journal of Fisheries, 45(2):221-224.
Vossughi, Ch. (= Wossughi, Gh.) and Mostajeer, B. 1994. Freshwater Fishes. Second Edition. Tehran University Publication No. 2132, 317 pp. (4th Edition, 2001). In Farsi.
Vuosalo-Tavakoli, E., Ghasempouri, M. and Yaghobzadeh, Y. 2018. A traditional Caspian agroecosystem for trapping migratory waterfowl acting as a potential avian sanctuary. Anthropology of the Middle East, 13(1):97-116.

W

Wagstaff, J. M. 1985. The evolution of Middle Eastern landscapes. An outline to A.D. 1840. Croom Helm, London. xiii + 304 pp.
Wais, A. 1995. Zur Morphologie des Sichlings *Pelecus cultratus* (Linnaeus) (Pisces: Cyprinidae). Annalen des naturhistorischen Museums in Wien, 97B:421-435.
Wardlaw, R. 2001. Kara Bogaz Gol as a regulator of Caspian Sea levels. TACIS (Technical Assistance to the Commonwealth of Independent States, European Union), Caspian Environment Programme, Centre for Water Level Fluctuations, Almaty (Nr WLF 12E). 11 pp.
Waring, E. S. 1807. A Tour to Sheeraz, by the route of Kazroon and Feerozabad; with various remarks on the manners, customs, laws, language, and literature of the Persians. To which is added a History of Persia, from the death of Kureem Khan to the subversion of the Zund Dynasty. T. Cadell and W. Davis, London. xiii + 329 pp.
Waring, G. A. 1965. Thermal Springs of the United States and Other Countries of the World - A Summary. United States Government Printing Office, Washington. ix + 383 pp.
Warpachowski, N. A. 1895. Neskol'ko dannykh po ikhtiofaune vostochnogo Zakavkaz'ya [Some data on the ichthyofauna of the eastern Transcaucasus]. Russkoye Sudokhodstvo, 158:25-35.
Warwick, D. and Warwick, J. 1989. The doctor fish - a cure for psoriasis? The Lancet,

334(8671):1093-1094.
Watson, M. F. and Noltie, H. J. 2016. Career, collections, reports and publications of Dr Francis Buchanan (later Hamilton), 1762-1829: natural history studies in Nepal, Burma (Myanmar), Bangladesh and India. Part 1. Annals of Science, 73(4):392-424.
Weber, A., Proudlove, G. S. and Nalbant, T. T. 1998. Morphology, systematic diversity, distribution, and ecology of stygobitic fishes, pp. 1177-1213. In: Juberthie, C. and Decu, V. (Eds.). Encyclopaedia Biospeleologica. Tome II. Société de Biospéologie, Moulis, Bucarest (Academie Roumaine).
Weier, J. 2002. From wetland to wasteland. The destruction of the Hamoun Oasis. Earth Observatory Features, NASA. http://earthobservatory.nasa.gov/Study/hamoun, downloaded 14 February 2003.
Weisi, T., Ahamdifard, N., Agh, N. and Kamali, M. 2019. The effect of Palangan fish farming on the macro-invertebrates of the Sirvan River using Shannon and Hilsinhof Biological Indices. Journal of Animal Environment, 11(3):345-354. In Farsi.
Werner, F. 1929. Beiträge zur Kenntnis der Fauna von Syrien und Persien. Zoologischer Anzeiger, 81(7/10):238-245.
Wessels, J. and Hoogeveen, R. J. A. 2003. Renovation of qanats in Syria. International Network on Water, Environment and Health, United Nations University, Japan. 25 pp.
White, P. G. 1988. A regional survey of the aquaculture sector in eleven Middle East countries (including Bahrain, Iraq, Islamic Republic of Iran, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates, Yemen Arab Republic and the People’s Democratic Republic of Yemen). Food and Agriculture Organization, Rome, Aquaculture Development and Coordination Programme, ADCP/REP/88/30:v + 50 pp.
White, T. F. 1987. Islamic Republic of Iran. Collection and analysis of fisheries data. A report prepared for the Fisheries Development Project, Food and Agriculture Organization, Rome, FI/DP/IRA/83/013:1-8.
Whitehead, P. J. P. and Talwar, P. K. 1976. Francis Day (1829-1889) and his collections of Indian fishes. Bulletin of the British Museum (Natural History), Historical Series, 5(1):1-189, 4 pls.
Whitley, A. and Gallagher, K. 1995. Karun River politics. Iran’s multi-billion dollar hydroelectric plans lay in the hands of foreign policymakers. Middle East Insight, 11(5):33-35.
Whitley, G. P. 1931. New names for Australian fishes. Australian Zoologist, 6(4):310-334, pls. 25-27.
Whitley, G. P. 1953. Studies in ichthyology No. 16. Records of the Australian Museum, 23(3):133-138.
Whitney, J. W. 2006. Geology, water, and wind in the lower Helmand Basin, southern Afghanistan. U.S. Geological Survey Scientific Investigations Report, 2006-5182, vi + 40 pp.
Whybrow, P. J. and Clements, D. 1999. Arabian Tertiary fauna, flora, and localities, pp. 460-473. In: Whybrow, P. J. and Hill, A. (Eds.). Fossil Vertebrates of Arabia with Emphasis on the Late Miocene Faunas, Geology, and Palaeoenvironments of the Emirate of Abu Dhabi, United Arab Emirates. Yale University Press, New Haven and London. xxv + 523 pp., 40 pp.
Whyte, R. O. 1961. Evolution of land use in South-western Asia, pp. 57-118. In: Stamp, L. D. Arid Zone Research - XVII. A history of land use in arid regions. UNESCO, Paris. 388

pp.
Wiepkema, P. R. 1961. Ethological analysis of the reproductive behaviour of the bitterling (Rhodeus amarus Bloch). Archives Néerlandaises de Zoologie, 14(2):103-109.
Wildekamp, R. H., Van Neer, W., Küçük, F. and Ünlüsayin, M. 1997. First record of the eastern Asiatic gobionid fish *Pseudorasbora parva* from the Asiatic part of Turkey. Journal of Fish Biology, 51(4):858-861.
Wilkens, H. 1977. Die Typen der Ichthyologischen Sammlung des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg (ZMH). Teil III. Mitteilungen aus dem hamburgischen zoologischen Museum und Institut, 74:155-163.
Wilkens, H. and Dohse, R. 1993. Die Typen der Ichthyologischen Sammlung des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg (ZMH) Teil IV. Mitteilungen aus dem hamburgischen zoologischen Museum und Institut, 90:401-426.
Williams, J. S., Gibson, D. I. and Sadighian, A. 1980. Some helminth-parasites of Iranian freshwater fishes. Journal of Natural History, 14(5):685-699.
Williams, W. D. 1996. The largest, highest and lowest lakes of the world: Saline Lakes. Verhandlungen der internationalen Vereinigung für theoretische und angewandte Limnologie, 26(1):61-79.
Wilson, M. 1995. Fisheries development Iran. Fisheries population dynamics and stock assessment course. Food and Agriculture Organization, Rome, FI-DP/IRA/83/013-field-document:1-25.
Wolfart, R. 1987. Late Cretaceous through Quaternary palaeogeographic evolution of the Middle East, pp. 9-22. In: Krupp, F., Schneider, W. and Kinzelbach, R. (Eds.). Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, Mainz, 1985. Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe A (Naturwissenschaften), 28, Dr. Ludwig Reichert Verlag, Wiesbaden, 338 pp.
Wolski, K. 1965. Les karez (Installations d'irrigation de terrains semi-désertiques) Afghanistan - Baloutchistan. Folia Orientalia, 6:179-204.
Woosley, A.-I. and Hole, Fr. 1978. Pollen evidence of subsistence and environment in ancient Iran. Paléorient, 4(1):59-70.
World Conservation Monitoring Centre. 1990. Directory of Wetlands of International Importance. Sites Designated for the List of Wetlands of International Importance. Ramsar Convention Bureau, Gland, Switzerland. 782 pp.
Wossughi, G. 1978. Beitrag zur Systematik und Zoogeographie der Cyprinidae (Pisces, Teleostei) des Mittleren Ostens, unter besonderer Berücksichtigung des Irans. Dissertation zur Erlangung des Doktorgrades des Fachbereichs Biologie der Universität Hamburg. 89 pp.
Wossughi, Gh. 1985. The identification of fresh-water fishes in the "Dashti" province of Bushehr. Fifth Congress of European Ichthyologists, Stockholm 12-16 August 1985, p. 158 (abstract).
Wossughi, G. H. 1987. Die Sueswasserfische des Hamun Sees. Journal of the Veterinary Faculty, University of Tehran, 41(3-4):83-97. In Farsi.
Wossughi, Gh., Ahmadi, M. R., Kiaghadi, R. and Nikoie, A. 1991. Ein Beitrag zur Fischfauna des Haraz Flusses. Journal of the Veterinary Faculty of the University of Tehran, 45(3):63-82. In Farsi.
Wossughi, Gh., Azari Takami, Gh., Khoschzahmat, A. and Ahmadi, M. R. 1981. Die Suesswasserfische des Parischan Sees sowie der Quellen und Flosse in der Umbegung

der Stadt Kaserun. Journal of the Veterinary Faculty of the University of Tehran, 37(1):103-125. In Farsi.
Wossughi, G. H., Khoshzahmat, A. and Etemadfar, A. 1982. Recognition of fresh-water fishes in the area between Noorabad of Mamasany, Kazeron and Dashtestan. Journal of the Veterinary Faculty of the University of Tehran, 38(1-3):23-44. In Farsi.
Wossughi, G. H. and Radmehr, B. 1983. An osteological study of the skull of some Iranian fishes (Part II). Journal of the Veterinary Faculty of the University of Tehran, 38(1):37-53. In Farsi.
Wossugh-Zamani, A. 1991a. Safid-rud. Abzeeyan, Tehran, 2:28-30. In Farsi.
Wossugh-Zamani, A. 1991b. Fluctuations in the Caspian Sea water level. Abzeeyan, Tehran, 2:10-14. In Farsi.
Wossugh-Zamani, A. 1991c. The Blackwater River and the roach. Abzeeyan, Tehran, 2:24-27. In Farsi.
Woynarovich, E. 1985. Iran consultancy on fisheries development. Food and Agriculture Organization, Rome. IRA/83/013:27 pp.
Wright, D. 1977. The English amongst the Persians during then Qajar Period 1787-1921. Heinemann, London. xv + 218 pp.
Wright, H. E. 1977. Environmental change and the origin of agriculture in the Old and New Worlds, pp. 281-318. In: Reed, C. A. Origins of Agriculture. Mouton, The Hague. xvi + 1013 pp.
Wright, H. E. 1983. Climatic change in the Zagros Mountains - revisited, pp. 505-510. In: Braidwood, L. S., Braidwood, R. J., Howe, B., Reed, C. A. and Watson, P. J. (Eds.). Prehistoric Archeology along the Zagros Flanks. Oriental Institute of Chicago University, Chicago. ix + 695 pp.
Wright, G. R. H. 1990. Of fishes and men. Fish symbols in ancient religion. Journal of Prehistoric Religion, 3-4:30-44.
Wright, H. E., McAndrews, J. H. and van Zeist, W. 1967. Modern pollen rain in western Iran, and its relation to plant geography and Quaternary vegetational history. Journal of Ecology, 55(2):415-443.
Wu, Y.-F. and Wu, C.-Z. 1992. The Fishes of the Qinghai-Xizang Plateau. Sichuan Publishing House of Science and Technology, Chengdu. 599 pp. In Chinese.
Wulff, H. E. 1968. The qanats of Iran. Scientific American, 218(4):94-105.

Y

Yachkaschi, A. 1976. Stand und Planung von Natur- und Nationalparken im Iran. Nature and National Parks, 14(53):12-13.
Yadkoori, N. R., Zanguee, N., Mousavi, S. M. and Zakeri, M. 2015. Effects of different levels of ginger extract on growth performance, nutrition and body biochemical composition of *Mesopotamichthys sharpeyi* fingerlings. Journal of Fisheries (Iranian Journal of Natural Resources), 68(3):397-407. In Farsi.
Yaghobi, M. 2012. Histological development of the alimentary channel of Caspian roach (*Rutilus rutilus caspicus*) from hatching to fingerling size. M.Sc. Thesis, University of Tehran, Tehran. In Farsi.
Yaghoubi, M., Mojazi Amiri, B., Nematollahi, M. A. and Yelghi, S. 2015. Histological development of the alimentary channel of Caspian roach (*Rutilus rutilus caspicus*).

Journal of Fisheries, 67(4):625-639, 12. In Farsi.
Yahyaee, R., Ghobadian, B. and Najafi, G. 2013. Waste fish biodiesel as a source of renewable fuel in Iran. Renewable and Sustainable Energy Reviews, 17:312-318.
Yahyaei, M., Gorgin, S., Stepputis, D., Saffaei, M. and Paighambari, S. Y. 2019. Standardization of mesh size in codend of the Miankaleh beach seine. Iranian Scientific Fisheries Journal 28(3):13-21. In Farsi.
Yahyaei, M., Gorgin, S., Stepputis, D., Saffaei, M. and Paighambari, S. Y. 2021. The effect of environmental conditions on catches in CPUE in beach seines tours in Miankaleh region of Golestan Province. Journal of Applied Ichthyological Research, 8(3):92-07. In Farsi.
Yahyazadeh, M. Y., Ahmadi, R., Najafpoor, N. and Shiri, S. 2007. Identification of native fishes of western Azarbaijan province - phase 1: northern water source. Iranian Fisheries Science Research Institute, Tehran. 94 pp. In Farsi.
Yahyazadeh, M. Y., Najafpour, N., Shiri, S., Ramin, M. and Chodarrezaei, S. 2015. Identification of native fishes of west Azarbaijan province phase 2. Iranian Fisheries Science Research Institute, Tehran. 99 pp. In Farsi.
Yahyazadeh, M. Y., Seidgar, M., Shiri, S. and Alizadeh Osalou, Zh. 2016. The report of *Garra rufa* on Zab River of west Azerbaijan and its importance in human health. New Technologies in Aquaculture Development (Journal of Fisheries), 10(1):61-66. In Farsi.
Yahyazadeh, M. Y., Shiri, S., Ramin, M. and Najafpour, N. 2014a. Identification of fishes in western catchment of Urmia Lake. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Yahyazadeh, M. Y., Shiri, S., Ramin, M. and Najafpour, N. 2014b. Identification of fishes of Zab River in West Azerbaijan Province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).
Yakhchali, M., Hobenaghi, R. and Ghavami, M. 2011. Pathological study of *Neoechinorhynchus* sp. (van Cleave, 1919) in gastrointestinal tract of *Barbus* sp. from the Zarrine-Roud River, Iran. Journal of Veterinary Research, 67(1):43-47. In Farsi.
Yakhchali, M. and Mahmudihesar, R. 2002. Survey of *Ichthyophthirius multifilis* abundance in cold water fish farms in West Azarbaijan in Iran. Pajouhesh va Sazandegi, 15(2)(55):58-59. In Farsi.
Yakovlev, V. E. 1870. On the new and little-known species of fish found in the mouths of the Volga. Protocol Zasedanii Obshchestva Estestvoispytately Kazanskogo Universiteta, 1870:101-111. In Russian.
Yakovlev, V. N. 1959. Ryby iz minotsenovykh otlozhenii Kirgizii [Fishes from the Miocene of Kirghizia]. Paleontologicheskii Zhurnal, 1959(3):107-111.
Yalçin-Özdilek, Ş. and Ekmekçi, F. G. 2006. Preliminary data on the diet of *Garra rufa* (Cyprinidae) in the Asi basin (Orontes), Turkey. Cybium, 30(2):177-182.
Yanar, M. and Tekelioğlu, N. 1999. Balık Büyüklü ğünün Japon Balıklarında (*Carassius auratus*) Pigmentasyon Üzerine Etkisi [The effect of fish size on pigmentation in goldfish (*Carassius auratus*)]. Turkish Journal of Biology, 23(1):101-105.
Yang, L., Arunachalam, M., Sado, T., Levin, B. A., Golubtsov, A. S., Freyhof, J., Friel, J. P., Chen, W-J., Hirt, M. V., Manickam, R., Agnew, M. K., Simons, A. M., Saitoh, K., Miya, M., Mayden, R. L. and He, S. 2012. Molecular phylogeny of the cyprinid tribe Labeonini (Teleostei: Cypriniformes). Molecular Phylogenetics and Evolution, 65(2):362-379.
Yang, L. and Mayden, R. L. 2010. Phylogenetic relationships, subdivision, and biogeography of the cyprinid tribe Labeonini (*sensu* Rainboth, 1991) (Teleostei: Cypriniformes), with

comments on implications of lips and associated structure in the labeonin classification. Molecular Phylogenetics and Evolution, 54(1):254-265.

Yang, L., Mayden, R. L., Sado, T., He, S., Saitoh, K. and Miya, M. 2010. Molecular phylogeny of the fishes traditionally referred to Cyprinini *sensu stricto* (Teleostei: Cypriniformes). Zoologica Scripta, 39(6):527-550.

Yang, L., Sado, T., Hirt, M. V., Pasco-Viel, E., Arunchalam, M., Li, J., Wang, X., Freyhof, J., Saitoh, K., Simon, A. M., Miya, M., He, S. and Mayden, R. L. 2015. Phylogeny and polyploidy: resolving the classification of Cyprinine fishes (Teleostei: Cypriniformes). Molecular Phylogenetics and Evolution, 85:97-116.

Yarshater, E. (Ed.). (Continuing). Encyclopædia Iranica. Routledge & Kegan Paul, London.

Yasari, Z., Javadian, S. R. and Saeidi Asl, M. R. 2015. Anti-oxidant and anti-bacterial effects of encapsulated nisin with nanoliposome on the fillets of silver carp (*Hypophthalmichthys molitrix*) during storage at refrigerated (4±1ºC). Journal of Aquatic Animals and Fisheries, 6(22):13-23. In Farsi.

Yasemi, M. and Nikoo, M. 2010. The impact of captivity on fertilization, cortisol and glucose levels in plasma in kutum broodstock. Iranian Journal of Fisheries Sciences, 9(3):478-484.

Yassaie, M. 1993. Common carp: Its status in present fish culture activities in Iran and its economical importance. In: Symposium on the Carp, Budapest, Hungary, 6-9 September 1993 (abstract).

Yavar, M., Rezaei Tavabe, K. and Taghavi, L. 2018. Investigation of different levels of water oxidation reduction potential (ORP) on physicochemical parameters of water, blood biochemical indices and cortisol hormone of the common carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(4):396-406. In Farsi.

Yavari, A., Gharaei, A., Ghaffari, M. and Sharifpour, I. 2013. Determination of LC_{50} and some histopathological changes due to diazinon in *Schizothorax zarudnyi* juveniles. Journal of Fisheries Science and Technology, 2(2):63-74. In Farsi.

Yazdandoost, F. 2016. Dams, drought and water shortage in today's Iran. Iranian Studies, 49(6):1017-1028.

Yazdani, S., Ramezani, M. R. and Rafiee, H. 2019. Environmental efficiency analysis of cage culture fish farming system; the case of Mazandaran Province. Agricultural Economics, 13(1):105-131. In Farsi.

Yazdani, S., Riahi, A. and Peykani, G. 2017. The economic analysis of pareh-cooperatives in the Mazandaran Province. Iranian Journal of Agricultural Economics and Development Research, 48(2):211-226. In Farsi.

Yazdani, Z., Vatandoust, S. and Khayatzadeh, J. 2019. Life history and other biological traits of *Capoeta buhsei* (Kessler, 1877) in the Gharachay River, Saveh. Iranian Journal of Fisheries Sciences, 18(4):790-797.

Yazdani, Z., Vatandoust, S., Khayatzadeh, J. and Sarpanah, A. N. 2016. An investigation on some biological characteristics of *Capoeta buhsei* in Gharachay River, Saveh. Iranian Scientific Fisheries Journal, 25(3):257-262. In Farsi.

Yazdani Moghaddam, F., Ghasemian, F., Ghassemzadeh, F., Ghanbarifardi, M. and Seifali, M. 2015. The fish fauna of North and East regions of Razavi Khorasan Province. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 141.

Yazdani-Moghaddam, F., Ghasemian, F., Ghassemzadeh, F., Khazaee, A. R., Seifali, M. and

Ghanbarifardi, 2015. The fish fauna of North and East regions of Khorasan-e-Razavi Province, Iran. Iranian Journal of Animal Biosystematics, 11(1):91-100.

Yazdani Rostam, M. M., Mashayekh Nia, M. J., Roudaki Sarvandani, M. R. and Rostami, A. 2017. A review of fishes at the risk of extinction of Iran freshwater fishes according to the IUCN red list. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017, pp. 53-58 see text In Farsi.

Yazdanpanah, K., Hosseini, S. and Heydari, M. 2017. The effect of effluent from trout farms on the physico-chemical factors of Ganjegan River in Kohgiluyeh and Boyer-Ahmad Province, Iran. New Technologies in Aquaculture Development (Journal of Fisheries), 11(1):9-18. In Farsi.

Yazdanpanah, L., Zorriehzahra, J. and Sheikhasadi, M. 2018. The study of monogenean parasites of freshwater some (*sic*) fish in farm ponds in Kerman Province. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Yazdanpanah, M. 2005. Reproductive biology of *Garra rufa* (Heckel, 1843) (Cypriniformes, Cyprinidae) in a spring-stream system, Zanjiran, Fars province. M.Sc. Thesis, Shiraz University. xiii + 136 pp. In Farsi.

Yazdanpanah Goharrizi, L. 2014. The study of pathogen factors on native fish in Baft River in Kerman Province. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Yazdanpanah Goharrizi, L., Zorriehzahra, M. E. J. and Adel, M. 2015. The study on effect of temperature stress on occurrence of clinical signs caused by *Aeromonas hydrophila* in *Capoeta damascina* in *in vitro* condition. Advances in Animal and Veterinary Sciences, 3(7):406-412.

Yazdanpanah Goharrizy, L. 2007. The study of thermal stressor effect on confession (*sic*) signs of *Aeromonas hydrophila* on *Capoeta damascina* in vitro condition. Journal of Large Animal Clinical Science Research (Journal of Veterinary Medicine), 1(2):29-34.

Yazdi, A. A. S. and Khaneiki, M. L. 2018. Qanāts of Iran, pp. 219-237. In: Sulas, F. and Pikirayi, I. (Eds.). Water and Society from Ancient Times to the Present: Resilience, Decline, and Revival. Routledge, London. xviii + 402 pp.

Yazdipour, A., Marashi, S. Z. and Moazedi, J. 1991. Biotechnological report on artificial propagation of *Barbus sharpeyi*. Iranian Fisheries Research and Training Organization Publication, Tehran. 34 pp. In Farsi.

Yedier, S., Kontaş, S., Bostancı, D. and Polat, N. 2016. Otolith and scale morphologies of doctor fish (*Garra rufa*) inhabiting Kangal Balıklı Çermik thermal spring (Sivas, Turkey). Iranian Journal of Fisheries Sciences, 15(4):1593-1608.

Yeganaeh, S., Aghili, K. and Amini, K. 2019. The investigation on variation of ionic and hormone indices in wild and wild cultivated carp brood stocks (*Cyprinus carpio* Linnaeus, 1758). Journal of Applied Ichthyological Research, 6(3):85-98. In Farsi.

Yeganeh, S., Abedi, Z. and Haghi, Z. 2014. The influence of salinity on growth indices and survival rate of grass carp (*Ctenopharyngodon idella*) fry. Journal of Aquatic Animals and Fisheries, 5(18):77-85. In Farsi.

Yeganeh, S., Abedi, Z. and Rahmani, H. 2013. A comparative study on some biological parameters in wild and farmed common carp (*Cyprinus carpio*). Journal of Animal Biology, 5(3):67-76. In Farsi.

Yeganeh, S., Esmaeili Kharyeki, M. and Ahmadi, H. 2021. Effect of hydrolysis time on the

antioxidant activity of common carp (*Cyprinus carpio*) head protein hydrolysate. Iranian Scientific Fisheries Journal, 29(6):29-42. In Farsi.

Yeganeh, S. and Maleki, P. 2013. Comparison of anesthetic effects produced by extracts of *Valeriana officinalis*, *Melissa officinalis* and *Salvia officinalis* on common carp (*Cyprinus carpio*). Journal of Utilization and Cultivation of Aquatics, 2(2):65-77. In Farsi.

Yeganeh, S., Shabanpour, B., Hosseini, H., Imanpour, M. R. and Shabani, A. 2010. An investigation of spawning effect on lipid quality changes of cultured common carp (*Cyprinus carpio*) fillet during frozen storage. Journal of Fisheries (Iranian Journal of Natural Resources), 63(1):57-69. In Farsi.

Yeganeh, S., Shabanpour, B., Hosseini, H., Imanpour, M. R. and Shabani, A. 2012. Comparison of farmed and wild common carp (*Cyprinus carpio*): Seasonal variations in chemical composition and fatty acid profile. Czech Journal of Food Sciences, 30(6):503-511.

Yeganeh, S., Shabanpour, B., Hosseini, M., Imanpour, M. R., Shabani, A. and Abasi, M. 2012. Assessment of seasonal variation of chemical composition and fatty acid profile of fillet in cultured common carp (*Cyprinus carpio*). Iranian Journal of Biology, 25(2):286-204. In Farsi.

Yehganeh, S., Shabanpour, B., Hosseini, H., Imanpour, M. R., Shaabani, A., Moeini, M. and Motalebi, A. A. 2009. Seasonal variation of chemical composition and fatty acid profile of ovary in wild common carp (*Cyprinus carpio*) of southeastern Caspian Sea. Iranian Scientific Fisheries Journal, 18(1):151-160. In Farsi.

Yektaye Gorabi, K., Bahonar, A. R. and Amini Fard, A. 2015. Investigation of consumption of seafood of Rasht City population and finding the effective factors on its demand. Journal of Utilization and Cultivation of Aquatics, 4(3):1-18. In Farsi.

Yelghi, S., Aghili, S. M. and Fazel, A. 2015. Analyses of production structure of aquaculture reservoirs in Golestan province in 2009. Journal of Utilization and Cultivation of Aquatics, 3(4):13-24. In Farsi.

Yelghi, S., Ghorbani, R., Aghili, S. M. and Mefadeykhewajh, E. 2015. Economic evaluation of aqua-agriculture reservoirs in Golestan Province in 2010. Journal of Utilization and Cultivation of Aquatics, 4(1):1-14. In Farsi.

Yelghi, S., Mazaheri Kohestani, Z. and Mokarami, S. G. 2014. An investigation of some biological features of *Cyprinus carpio* (Linnaeus, 1758) in Gorgan Rud estuary. Journal of Applied Ichthyological Research, 1(4):81-94. In Farsi.

Yerli, S. V., Çalişkan, M. and Canbolat, A. F. 1999. An investigation on the growth criterias of *Leuciscus cephalus* in Çıldır Lake-Ardahan. Turkish Journal of Zoology, 23 (EK1):271-278.

Yerli, S. V., Mangıt, F., Emiroğlu, Ö., Yeğen, V., Uysal, R., Ünlü, E., Alp, A., Buhan, E., Yıldırım, T. and Zengin, M. 2014. Distribution of invasive *Carassius gibelio* (Bloch, 1792) (Teleostei: Cyprinidae) in Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 14(2):581-590.

Yıldırım, A., Halıloğlu, H. I., Erdoğan, O. and Türkmen, M. 2007. Some reproduction characteristics of *Chalcalburnus mossulensis* (Heckel, 1843) inhabiting the Karasu River (Erzurum, Turkey). Turkish Journal of Zoology, 31(2):193-200.

Yilmaz, M., Çiğremiş, Y., Türköz, Y. and Gaffaroğlu, M. 2005. A taxonomic study on Orthrias insignis euphraticus (Banarescu and Nalbant, 1964) and Cyprinion macrostomus (Heckel, 1843) by sarcoplasmic protein electrophoresis. Gazi University Journal of Science,

18(1):61-68.
Yosefzad, E., Nezami, Sh., Khara, H. and Mirzajani, A. R. 2014. Determination of macrobenthic production in order to aquaculture activity in Golabar Lake of Zanjan. Journal of Aquaculture Development, 8(1):83-93. In Farsi.
Younesipour, H., Nasrollahzadeh Saravi, H. and Sadateapour, S. T. 2014. Study on bioaccumulation of essential (Fe, Cu, Zn) and semi-essential (Ni, Co, Mn) heavy metals in the edible tissue of *Cyprinus carpio* of the Caspian Sea. Journal of Aquaculture Development, 8(1):95-106. In Farsi.
Young, G. 1976. Water dwellers in a desert world. National Geographic, 149(6):502-523.
Young, G. 1989. Return to the Marshes. Life with the Marsh Arabs of Iraq. Penguin, London. 192 pp.
Younis, K. H., Hussain, N. A. and Yousif, U. H. 2001a. Occurrence, age, growth and food habits of *Acanthobrama marmid* Heckel (Cyprinidae) in Shatt Al-Arab River at Basrah, Iraq. Iraqi Journal of Biology, 1(1):59-70.
Younis, K. H., Hussain, N. A. and Yousif, U. H. 2001b. Food and diet overlap of small fish assemblage in the upper reaches of Shatt Al-Arab River, Iraq. Marina Mesopotamica, 16(1):129-139.
Yousefi, M., Ghafarifarsani, H., Hoseinifar, S. H., Rashidian, G. and Van Doan, H. 2021. Effects of dietary marjoram, *Origanum majorana* extract on growth performance, hematological, antioxidant, humoral and mucosal immune responses, and resistance of common carp, *Cyprinus carpio* against *Aeromonas hydrophila*. Fish and Shellfish Immunology, 108:127-133.
Yousefi, M., Hoseini, S. M., Vatnikov, Y. A., Kulikov, E. V. and Drukovsky, S. G. 2019. Rosemary leaf powder improved growth performance, immune and antioxidant parameters, and crowding stress responses in common carp (*Cyprinus carpio*) fingerlings. Aquaculture, 505:473-480.
Yousefi, M., Hoseinifar, S. H., Ghelichpour, M. and Hoseini, S. M. 2018. Anesthetic efficacy and biochemical effects of cironellal and linalool in common carp (*Cyprinus carpio* Linnaeus, 1758) juveniles. Aquaculture, 493:107-112.
Yousefi, M., Jouladeh Roudbar, A. and Ghanavi, H. R. 2018a. Coverage of protected areas for desirable habitats of inland ecological species of Iran *Garra persica* Berg, 1914. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Yousefi, M., Jouladeh Roudbar, A. and Ghanavi, H. R. 2018b. Predict the effects of climate change on the distribution of *Capoeta buhsei* Kessler, 1877 in the inland waters of Iran. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).
Yousefi, M., Jouladeh Roudbar, A. and Kafash, A. 2020. Using endemic freshwater fishes as proxies of their ecosystem to identify high priority rivers for conservation under climate change. Ecological Indicators, 112:106137.
Yousefi, M., Kafash, A., Valizadegan, N., Ilanloo, S. S., Rajabizadeh, M., Malekoutikhah, S., Hosseinian Yousefkhani, S. S. and Ashrafi, S. 2019. Climate change is a major problem for biodiversity conservation: A systematic review of recent studies in Iran. Contemporary Problems of Ecology, 12(4):394-403.
Yousefi, M., Shabunin, S. V., Vatnikov, Y. A., Kulikov, E. V., Adineh, H., Khademi Hamidi, M. and Hoseini, S. M. 2020. Effects of lavender (*Lavandula angustifolia*) extract inclusion in

diet on growth performance, innate immunity, immune-related gene expression, and stress response of common carp, *Cyprinus carpio.* Aquaculture, 515:734588.

Yousefi, M., Vatnikov, Y. A., Kulikov, E. V., Plushikov, V. G., Drukovsky, S. G., Hoseinifar, S. H. and Van Doan, H. 2020. The protective effects of dietary garlic on common carp (*Cyprinus carpio*) exposed to ambient ammonia toxicity. Aquaculture, 526:735400.

Yousefi, M. R., Sefidgar, A. A., Maliji, Gh., Mousavi, J. and Asna-Ashari, M. Y. 2005. Infection of river whitefishes (*Rutilus rutilus*) by *Ligula intestinalis* parasite in Aras Dam. Journal of Babol University of Medical Sciences, 7(2):80-83. In Farsi.

Yousefi Jourdehi, Y., Atdali, S., Zandijan, A., Allahkazemi, R., Sudagar, M., Shokouhi, S., Shokouri, M. and Moradine, A. A. 2012. Behavioral and morphopathological responses of silver carp (*Hypophthalmichthys molitrix*) to acute toxicity of copper and zinc. Journal of Utilization and Cultivation of Aquatics, 1(3):15-28. In Farsi.

Yousefi Siahkalroodi, S., Khoshkhoo, Z., Mohseni, S. and Yousefi Siahkalroodi, M. 2020. Determination of nutritional value and amino acid profile in Asian sea bass (*Lates calcarifer*) cultured in cages and comparing them with rainbow trout (*Oncorynchus mykiss*), common carp (*Cyprinus carpio*) and Nile tilapia (*Oreochromis niloticus*). Journal of Fisheries (Iranian Journal of Natural Resources), 72(4):409-418. In Farsi.

Yousefian, M. 2004. Morphometric and electrophoretic comparison of common carp (*Cyprinus carpio* L.) in north of Iran. Iranian Scientific Fisheries Journal, 13(3):179-198. In Farsi.

Yousefian, M. 2005. Generating gynogenetic common carp (*Cyprinus carpio* L.) by gamma ray. Iranian Scientific Fisheries Journal, 14(3):183-198. In Farsi.

Yousefian, M. 2011a. Genetic variations of common carp (*Cyprinus carpio* L.) in south-eastern part of Caspian Sea using five microsatellite loci. World Journal of Zoology, 6(1):56-60.

Yousefian, M. 2011b. Study on morphological variation in Iran grass carp stocks. World Applied Sciences Journal, 12(8):1234-1239.

Yousefian, M. 2011c. The relationship between egg size, fecundity and fertilization rate in *Acipenser persicus*, *Rutilus ferissi* (*sic*) *kutum* and *Cyprinus carpio*. World Applied Sciences Journal, 12(8):1269-1273.

Yousefian, M. 2011d. Environmental factors influencing on migratory behavior of *Rutilus frisii kutum* in Shiroud River. World Applied Sciences Journal, 13(7):1572-1579.

Yousefian, M., Gezel, H. G. and Hedayatifard, M. 2008. Induction of ovulation in endemic *Chalcarburnus* (*sic*) chalcoides, living in the Caspian Sea, using LRH-Aa combined with metoclopramide. African Journal of Biotechnology, 7(22):4199-4201.

Yousefian, M., Hedayatifard, M., Farabi, S. V., Bigom Norouzian, M., Nikkho, A. M., Makhtomi, C. and Noori, A. 2018. The effects of zeolite on growth parameters of common carp of Caspian Sea. New Technologies in Aquaculture Development (Journal of Fisheries), 12(2):58-66. In Farsi.

Yousefian, M., Hedayatifard, M. and Sadeghifar, H. 2010. Evaluation of zeolit effects on some immunity and enzymatic factors of Mazandaran common carp (*Cyprinus carpio*). Journal of Fisheries, 3(4):1-10. In Farsi.

Yousefian, M., Keshavarz, K. and Yagoubi Kafshkari, Y. 2013. Principal components analysis of *Alburnus mossulensis* morphology. International Journal of Plant, Animal and Environmental Sciences, 3(1):160-165.

Yousefian, M. and Laloei, F. 2011. Genetic variations and structure of common carp, (*Cyprinus carpio*) populations by use of biochemical, mitochondrial and microsatellite markers.

Middle East Journal of Scientific Research, 7(3):339-345.
Yousefian, M. and Mosavi, H. 2008. Spawning of south Caspian kutum (*Rutilus frisii kutum*) in most migratory river of south Caspian Sea. Asian Journal of Animal and Veterinary Advances, 3(6):437-442.
Yousefian, M., Nikkhoo, M., Safari, R. and Nikkhoo, M. 2010. Evaluation of aqualase as probiotic on wild carp (*Cyprinus carpio*) growth, immunity characteristics and resistance to Streptococcosis. Research Journal of Fisheries and Hydrobiology, 5(2):173-178.
Yousefian, M., Norouzian Amiri, M. B., Magtomi, C. H., Mousavi, H., Hedayatifard, M., Laloei, F. and Farabi, S. M. V. 2009. The reproduction normative and genetic characteristic of endemic common carp *Cyprinus carpio* of Caspian Sea. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 59 (abstract).
Yousefian, M., Sharifrohani, M., Hosseinzadeh-Sahafi, H., Laloei, F. and Makhdoomi, C. 2011. Heritability estimation for growth-related traits in juvenile wild common carp (*Cyprinus carpio* L.) in the south of Caspian Sea. Iranian Journal of Fisheries Sciences, 10(4):740-748, XVI.
Yousefian, M., Yagoubi Kafshkari, Y. and Keshavarz, K. 2013. Principal components analysis of *Chondrochilus reginus* (*sic*) morphology. International Journal of Plant, Animal, and Environmental Sciences, 3(1):130-135.
Yousefzade, F., Nezami, Sh. A. and Khara, H. 2012a. A survey on hematological parameters of *Capoeta capoeta gracilis* in Talar River Qaemshahr, Mazandaran. Journal of Aquatic Animals and Fisheries, 3(11):67-75. In Farsi.
Yousefzade, F., Nezami, Sh. A. and Khara, H. 2012b. The study of blood serum biochemical parameters of *Capoeta capoeta gracilis* of Siyahroud River Qaemshahr. Journal of Animal Physiology and Development (Journal of Biological Sciences), 5(4):35-42. In Farsi.
Yousefzadeh, F. and Khara, H. 2015. Changes in blood chemistry and hematological indices of *Capoeta capoeta gracilis* in relation to age, sex, and geographic location. Comparative Clinical Pathology, 24(4):791-795.
Yousefzadeh, F., Nezami, Sh. and Khara, H. 2014. Comparison of cellular and biochemical blood factors in *Capoeta capoeta gracilis* in Siyahroud and Talar rivers in Mazandaran Province. Journal of Animal Biology, 6(2):93-101. In Farsi.
Youssefi, M. R., Hosseinifard, S. M., Halimi, M. and Kordafshari, S. 2012. Determination of the electrophoretic pattern of somatic and excretory-secretory proteins of *Ligula intestinalis* parasite in spirlin (*Alburnoides bipunctatus*). Tropical Biomedicine, 29(4):519-523.
Youssefi, M. R., Sefidgar, A. A., Maligi, Gh., Mousavi, J. and Asnaashari, M. Y. 2005. Infection of river whitefishes (*Rutilus rutilus*) by *Ligula intestinalis* parasite in Aras Dam; case series. Journal of Babol University of Medical Sciences, 7(2):80-83. In Farsi.
Yüksel, E and Gaffaroğlu, M. 2008a. NOR phenotype of *Cyprinion macrostomus* (Osteichthyes, Cyprinidae). Journal of Fisheries Sciences, 2(2):114-117.
Yüksel, E and Gaffaroğlu, M. 2008b. The analysis of nucleolar organizer regions in *Chalcalburnus mossulensis* (Pisces: Cyprinidae). Journal of Fisheries Sciences, 2(3):587-591.
Yüksel, F., Alp, A., Gündüz, F., Zülfü Çoban, M. and Demiril, F. 2014. Estimation of the population size of *Capoeta umbla* (Heckel, 1843) in the Lake Hazar (Elazig) by removal method. Digest Journal of Nanomaterials and Biostructures, 9(1):167-174.
Yulghi, S., Ghorbani, R. and Aghili, S. M. 2011. Evaluation of fish profitability by catched

beach seine, located in southeast of Caspian Sea, Golestan Province. New Technologies in Aquaculture Development (Journal of Fisheries), 4(4):57-66. In Farsi.
Yussefian, M. 2002. Biochemical composition of *Mnemiopsis leidyi* and its relation to population outburst in Caspian Sea. Iranian Journal of Marine Sciences, 1(3):65-70, 73. In Farsi.

Z

Zabihi, A., Faramarzi, M., Kiaalvandi, S., Iranshahi, F. and Roozbehfar, R. 2011. Effects of sodium selenite (Se ion) on feed utilization and some hematological parameters factors of *Cyprinus carpio* fish. World Journal of Fish and Marine Sciences, 3(5):396-402.
Zabihi, A., Faramarzi, M., Lashkarbolouki, M., Kiaalvandi, S. and Iranshahi, F. 2011. Effects of chicken slaughter wastes on growth and feeding parameters and body composition of common carp (*Cyprinus carpio*). Journal of Research in Biology, 1(2):122-128.
Zabihi, M. 2006. Some aspects of reproductive biology of *Schizothorax zarudnyi*. Iranian Fisheries Research Organization, Agriculture Research and Education Organization, Ministry of Jihad-e-Agriculture, Zabol. http://en.ifro.ir (abstract).
Zabihy, M., Pourkazemi, M., Kazemi, R. and Kamalai, A. 2004. Determination spawning season and changes in reproductive cycle of *Schizothorax zarudnyi* and condition factor in Hamoon Lake. Iranian Scientific Fisheries Journal, 12(4):41-56. In Farsi.
Zadeh, M. K., Maramzy, J. G., Preetha, K., Mansour, N., Ebrahim, R. Z. G. and Vahid, Y. 2009. Optimal dietary carbohydrate to lipid ratio in gattan Barbus xanthopterus fingerlings. The 6th Scientific Conference of Fisheries Resources, 3-4 March 2009, Basrah, p. 96 (abstract).
Zadmajid, V. 2016. Comparative effects of human chorionic gonadotropin (hCG) and Ovaprim™ (sGnRHa + domperidone) on the reproductive characteristics of wild-caught male Longspine scraper, *Capoeta trutta* (Heckel, 1843). Aquaculture, 463:7-15.
Zadmajid, V. 2017. Investigating reproductive indicators in age groups of 2 and 3 years olds of male *Capoeta trutta* (Heckel, 1843) in Gheshlagh River during the breeding season, Journal of Applied Ichthyological Research, 4(4):55-66. In Farsi.
Zadmajid, V., Bahrami Kamangar, B. and Fatholahi, T. 2017. Reproductive indices of male Caspian kutum (*Rutilus frisii*) in Gheshlagh River (Sanandaj, Iran). Journal of Aquaculture Development, 11(4):67-78. In Farsi.
Zadmajid, V., Bashiri, S., Sharafi, N. and Butts, I. A. E. 2018. Effect of hCG and Ovaprim™ on reproductive characteristics of male Levantine scraper (*Capoeta damascina)*. Theriogenology, 115:45-56**.**
Zadmajid, V. and Butts, I. A. E. 2018. Spawning performance, serum sex steroids, and ovarian histology in wild-caught Levantine scraper, *Capoeta damascina* (Valenciennes, 1842) treated with various doses of sGnRHa + domperidone. Journal of Animal Science, 96(12):5253-5264.
Zadmajid, V., Falahipour, E., Ghaderi, E., Sørensen, S. R. and Butts, I. A. E. 2019. Outcomes of in vitro fertilization with frozen-thawed sperm: An analysis of post-thaw recovery of sperm, embryogenesis, offspring morphology, and skeletogenesis for a cyprinid fish. Developmental Dynamics, 248(6):449-464.
Zadmajid, V. and Imanpour, M. R. 2007. The correlation between some biochemical and spermatological parameters in bream, *Abramis brama*, semen. Journal of Marine

Sciences and Technology, 6(1-2):57-63. In Farsi.
Zadmajid, V. and Imanpour, M. R. 2009. The correlation between some biochemical and spermatological parameters in goldfish (*Carassius auratus*) semen. Journal of Agricultural Sciences and Natural Resources, 16(1):54-61. In Farsi.
Zadmajid, V., Imanpour, M. R., Soudagar, M. and Shaabani, A. 2008. Comparison of the injection effects of GnRHa, HCG and pituitary extract on spermatological parameters in goldfish (*Carassius auratus*). Journal of Agricultural Sciences and Natural Resources 15(1):65-72. In Farsi.
Zadmajid, V., Imanpour, M. R., Soudagar, M. and Shaabani, A. 2009. The effects of GnRHa, HCG and pituitary extract on biochemical parameters of seminal plasma in goldfish (*Carassius auratus gibelio*). Iranian Journal of Biology, 22(2):333-342. In Farsi.
Zadmajid, V., Sheikahmadi, A., Kamangar, B. and Javadi, T. 2016. The effects of thyme oil extract to reduce toxic effects of nanosilver on growth factors and serum biochemical in goldfish (*Carassius auratus gibelio*). Journal of Aquatic Ecology, Hormozgan University, 5(4):12-21. In Farsi.
Zadmajid, V., Sørensen, S. R. and Butts, I A. E. 2019. Embryogenesis and early larval development in wild-caught Levantine scraper, *Capoeta damascina* (Valenciennes, 1842). Journal of Morphology, 280(1):133-148.
Zafarnejad, F. 2009. The contribution of dams to Iran's desertification. International Journal of Environmental Studies, 66(3):327-341.
Zaherbin, M., Vatandoost, S., Ghorbani, R. and Nowrooz Rajabi, A. R. 2013. An investigation on the age, growth and reproduction of *Capoeta capoeta gracilis* Keyserling, 1861 in Shirud River, Mazandaran province. Journal of Applied Ichthyological Research, 1(1):87-100, 7. In Farsi.
Zahmatkesh, A., Karimzadeh, K. and Faridnia, M. 2020. Effect of dietary selenium nanoparticles and chitosan oligosaccharide on biochemical parameters of Caspian roach (*Rutilus caspicus*) under malathion stress. Caspian Journal of Environmental Sciences, 18(1):59-71.
Zahmatkesh, F., Rahbar, M. and Farasati, S. 2021. Efficiency Bioactive compounds of fish by-products in the health and food industries. The second national conference on the conservation of Iranian endemic fishes; with special reference to the fishes of the Caspian Sea basin, University of Guilan, 24th February 2021 (abstract).
Zahmetkesh, M., Nezami, S., Khara, H., Baradaran Noveiri, S., Dadras, H. and Roodabeh, R. 2012. Study of ion and spermatocrite correlation with reproductive performance in *Aristichthys nobilis*. The Second National Conference on Fisheries Sciences and Aquatic Organisms, Iran-Lahijan, May 10-12, 2012 (poster).
Záhorská, E., Kováč, V., Falka, I., Beyer, K., Katina, S., Copp, G. H. and Gozlan, R. E. 2009. Morphological variability of the Asiatic cyprinid, topmouth gudgeon *Pseudorasbora parva*, in its introduced European range. Journal of Fish Biology, 74(1):167-185.
Zaidi, I. H. 1981. On the ethics of Man's interaction with the environment: an Islamic approach. Environmental Ethics, 3(1):35-47.
Zaker Hosseini, F., Abdoveis, S. and Cheraghi, M. 2007. Assessment of river ghanats Shushtar. International History Seminar on Irrigation and Drainage, Tehran-Iran, 2-5 May 2007, pp. 205-214.
Zakeri, H. 1997. Water catchment area of the Caspian Sea. Abangan, Student Quarterly of the Water Engineering Faculty of Khajeh Nassir ud-Din Tousi, 1997(12)

(www.netiran.com/Htdocs/Clippings/Social/970700XXSO02.html).

Zakeri, M. 2018. Effects of dietary supplementation of synbiotic on growth performance, feed utilization and body biochemical composition of benni, *Mesopotamichthys sharpeyi*. Journal of Animal Researches (Iranian Journal of Biology), 30(4):526-538. In Farsi.

Zakeri, M., Akbarzadeh, A. and Naji, A. 2019. Microplastic pollution in Caspian kutum (*Rutilus frisii kutum*) on southern shores of the Caspian Sea. Journal of Animal Environment, 11(1):175-180. In Farsi.

Zakeri, M., Maramazi, M., Taghi Ronagh, M., Kochanian, P. and Haghi, M. 2017. Food habits of *Capoeta trutta* Heckel, 1843, in Sezar River from Tigris catchment in Lorestan province. Journal of Animal Researches (Iranian Journal of Biology), 30(3):431-441. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Ramezani Fard, E., Fatemi, S., Valipour, A., Mashinchian Moradi, A., Khalili, V., Amri, S., Khomeyrani, R. and Ramin, M. 2020. Ontogeny of the alterations of digestive enzymes of *Alburnus chalcoides*. Journal of Animal Researches (Iranian Journal of Biology), 32(4):405-419. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Tootoonchi, S. and Khoshnood, Z. 2018. Histological study of gastrointestinal tract and accessory glands in mature shemaya (*Alburnus chalcoides*), roach (*Rutilus rutilus caspicus*) and goldfish (*Carassius auratus auratus*). Iranian Scientific Fisheries Journal, 27(1):139-148. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Valipour, A., Fatemi, S. M. R. and Ramezani Fard, E. 2018. A study on the morphology, histochemistry and histology comparison of the gastrointestinal tract of *Alburnus chalcoides* of the Caspian Sea during the larval, infant and premature periods. Journal of Animal Environment, 10(3):279-288. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Valipour, A., Fatemi, S. M. R. and Ramezani Fard, E. 2019. Morphology of *Alburnus chalcoides* during growth. Journal of Animal Environment, 11(3):163-172. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Valipour, A., Fatemi, S. M. R., Ramezani Fard, E., Pousty, I. and Khoshnood, Z. 2018. Morphological, histological, and histochemical study of the gastrointestinal duct and appendices of the mature *Alburnus chalcoides* of the Caspian Sea. Journal of Animal Researches (Iranian Journal of Biology), 31(3):316-328. In Farsi.

Zakeri Nasab, M., Jamili, Sh., Valipour, A. R., Fatemi, S. M. R. and Ramezani Fard, E. 2020. Ontogenetic development of the digestive system in *Alburnus chalcoides* larvae and juveniles. Iranian Journal of Fisheries Sciences, 19(4):2159-2172.

Zakipour Rahimabadi, E. 2015. Comparison of fatty acid profile in muscle and liver of male and female of *Schizothorax zarudnyi*. Journal of Fisheries, 67(4):523-531, 5. In Farsi.

Zakipour Rahimabadi, E., Arshadi, A., Zare, P. and Heydari, M. R. 2009. The comparative study of muscle chemical composition of *Schizothorax zarudnyi* and *Schizocypris altidorsalis* in different seasons and sex. Journal of Fisheries, 3(3):15-20. In Farsi.

Zakipour Rahimabadi, E. and Dad, S. 2012. Effects of frying by different frying oils on fatty acid profile of silver carp (*Hypophthalmichthys molitrix*). Iranian Journal of Fisheries Sciences, 11(3):704-712, xx.

Zakipour Rahimabadi, E., Elyasi, A., Sahari, M. A. and Zare, P. 2011. Effects of frying on proximate and fatty acid characteristics of fish fingers made from mince and surimi of common carp (*Cyprinus carpio*). Iranian Journal of Food Science and Technology, 8(29):1-9. In Farsi.

Zakipour Rahimabadi, E., Zolfaghari, M. and Rigi, M. 2015. The effects of washing with tamarind (*Tamarindus indica* L.) water solution on shelf life of silver carp

(*Hypophthalmichthys molitrix*) fillet during refrigeration storage. International Journal of Aquatic Biology, 3(5):352-361.

Zakir, F., Imanpour Neman, J., Sattari, M. and Hadavi, M. 2016. Lysozyme activity in blood serum and epidermal mucus of *Rutilus frisii* in brackish and freshwater ecosystems. Journal of Aquaculture Development, 10(1):53-61. In Farsi.

Zalagi, A. 2011. Study of habitat and population of the Iranian cave fish. M.Sc. Thesis, Islamic Azad University, Tehran.

Zallaghi, F., Haeri Pur, S. and Askarisari, A. 2011. Concentrations of lead and cadmium in liver and muscle tissues of fish (*Barbus pectoralis*) in the Karun River. Journal of Wetland Ecobiology, 2(8):67-75. In Farsi.

Zamani, F. and Keivany, Y. 2018. Study of the relationship between length and weight and status of *Cyprinion watsoni* fish in Sarbaz, Minab and Shur rivers. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Zamani, H., Ghasemi, M., Hosseini, S. M. and Haghighi Karsidani, S. 2013. Isolation and identification of spring viremia of carp virus from the Caspian white fish, *Rutilus frisii kutum*, after oral and horizontal transmission challenge models. Journal of Marine Biology, 5(18):1-9. In Farsi.

Zamani, H., Ghasemi, M., Hosseini, S. M. and Haghighi Karsidani, S. 2014. Experimental susceptibility of Caspian white fish, *Rutilus frisii kutum* to spring viraemia of carp virus. Virus Disease, 25(1):57-62.

Zamani Faradonbe, M. and Eagderi, S. 2015. Fish assemblages as influenced by environmental factors in Taleghan River (the Caspian Sea basin, Alborz Province, Iran). Caspian Journal of Environmental Sciences, 13(4):363-371.

Zamani Faradonbe, M. and Eagderi, S. 2016. Morphological comparison of Kura barbel (*Barbus cyri*, (Heckel, 1834)) in up and downstream of the Sangban Dam. Journal of Wetland Ecobiology, 7(4):87-96. In Farsi.

Zamani Faradonbe, M., Eagderi, S. and Moradi, M. 2015. Patterns of body shape variation in *Capoeta gracilis* (Pisces; Cyprinidae) in relation to environmental variables in Sefidrud River basin, Iran. Journal of Applied Biological Sciences, 9(1):36-42.

Zamani Faradonbe, M., Eagderi, S. and Poorbagher, H. 2014. Study of habitat suitability index of Kura barbel (*Barbus cyri* Filippi, 1865) in Taleghan River (Sefidrud River basin: Alborz Province). Journal of Applied Ichthyological Research, 2(2):41-54. In Farsi.

Zamani Faradonbe, M., Eagderi, S. and Poorbagher, H. 2017. Niche overlap in fish assemblages inferred from canonical correspondence analysis: A case study with the Totkabon River, north of Iran. Ege Journal of Fisheries and Aquatic Sciences, 34(2):151-156.

Zamani Faradonbe, M., Eagderi, S., Poorbagher, H. and Shahbazi Naserabad, S. 2015. Ecomorphology of Kura barbel (*Barbus cyri*, De Filippi 1865) in Sefidrud River basin. Journal of Aquatic Ecology, Hormozgan University, 5(1):24-33. In Farsi.

Zamani Faradonbe, M., Eagderi, S. and Shahbazi Naserabad, S. 2015. Length-weight relationships and condition factor of three fish species from Taleghan River (Alborz Province, Iran). Journal of Advanced Botany and Zoology, 2(3):1-3.

Zamani Faradonbe, M., Eagderi, S. and Zarei, N. 2015. Determination of habitat suitability index of *Capoeta gracilis*, Keyserling 1861 from Taleghan River. Journal of Fisheries (Iranian Journal of Natural Resources), 68(3):409-419. In Farsi.

Zamani Faradonbe, M. and Keivany, Y. 2017. Descriptive osteology of Persian stone lapper

(*Garra persica*) from Sistan basin. Journal of Animal Researches (Iranian Journal of Biology), 30(3):346-357. In Farsi.

Zamani Faradonbe, M. and Keivany, Y. 2018. Comparison of morphometric characteristics of three populations of *Cyprinion watsoni* in Sarbaz, Minab and Shur rivers. Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Zamani-Faradonbe, M. and Keivany, Y. 2021a. Biodiversity and distribution of *Garra* species (Teleostei: Cyprinidae) in Iran. Iranian Journal of Fisheries Sciences, 20(1):276-291.

Zamani-Faradonbe, M. and Keivany, Y. 2021b. Descriptive study of some osteological parts of rosy stone lapper (*Garra rossica*) from Mashkid Basin of Iran. Hindawi International Journal of Zoology, doi:10.1155/2021/5525109.

Zamani-Faradonbe, M., Keivany, Y. and Dorafshan, S. 2019. Phenotypic diversity in Hari garra, *Garra rossica* (Nik'olskii, 1900) populations (Cyprinidae) in Iranian river systems. Journal of Wildlife and Biodiversity, 3(3):1-9.

Zamani-Faradonbe, M., Keivany, Y. and Dorafshan, S. 2020. Osteological plasticity of *Garra rufa* populations in Iranian inland waters (Teleostei: Cyprinidae). Iranian Journal of Ichthyology, 7(1):103-119.

Zamani-Faradonbe, M., Keivany, Y., Dorafshan, S. and Abbasi-Jeshvaghani, M. 2020. Body shape variation of *Garra rufa* (Heckel) (Teleostei: Cyprinidae) using geometric and morphometric techniques. Journal of Animal Diversity, 2(1):127-140.

Zamani-Faradonbe, M., Keivany, Y., Dorafshan, S. and Zhang, E. 2021. Two new species of *Garra* (Teleostei: Cyprinidae) from western Iran. Ichthyological Exploration of Freshwaters, 30(3):249-270.

Zamani-Faradonbe, M., Keivany, Y. and Khoshnamvand, H. 2018. Length-weight and length-length relationships of four *Garra* species from Iranian basins. Journal of Applied Ichthyology, 34(6):1376-1378.

Zamani Faradonbeh, M., Eagderi, S. and Ghojoghi, F. 2015. Length-weight relationship and condition factor of seven fish species of Totkabon River (southern Caspian Sea basin), Guilan, Iran. International Journal of Aquatic Biology, 3(3):172-176.

Zamani Faradonbeh, M., Eagderi, S. and Nasri, M. 2015. Geometrics morphometric comparison of populations of waspi *Cabdio morar* (Hamilton, 1822) in Mashkil and Mokran basins. Iranian Scientific Fisheries Journal, 23(2):61-72. In Farsi.

Zamani Faradonbeh, M., Eagderi, S. and Pourbagher, H. 2015. Suitability index of large-scale habitat variables of Taleghan River fishes. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 34.

Zamani Faradonbeh, M., Eagderi, S., Pourbagher, H. and Asadi, H. 2014. Phenotypic plasticity of body shape in populations of Kura barbel (*Barbus lacerta*, Heckel 1834) in Sefidrud basin using geometric morphometrics technique. Journal of Fisheries Science and Technology, 3(3):91-96. In Farsi.

Zamani Faradonbeh, M., Eagderi, S. and Shahbazi Naserabad, S. 2014. Study effect of Taleghan dam on length-weight relationship of Kura barbel *(Barbus lacerta*, Heckel 1834). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Zamanian Nejad, R., Tabiee, O. and Esmaeili, H. R. 2015. The ichthyofauna of headwaters of three riverine systems in Kohgiluyeh and Boyer-Ahmad Province in southwest of Iran.

The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 167.

Zamanian Zadeh, B., Sadeghi Limanjoob, R., Golchin Manshadi, A., Farzam, M. and Soleymani, S. 2015. Morphometric-meristical and micro and macro anatomical study of caught fish from Heleh Wetland catchment area of the city of Bushher. Advances in Environmental Biology, 9(4):573-579.

Zamaniannejad, R., Esmaeili, H. R. and Tabiee, O. 2015. The ichthyofauna of headwaters of three riverine systems in Kohgiluyeh and Boyer-Ahmad Province in southwest of Iran. Iranian Journal of Science and Technology, Transaction A, 39(2):117-121.

Zamaninejad, Sh., Shabanpour, B. and Shabani, A. 2014. Characterization of farmed carp (*Cyprinus carpio*) surimi gel in medium temperature by increasing the setting time. Journal of Nutrition Sciences and Food Technology, 9(3):101-109. In Farsi.

Zamanpoore, M. 2017. Study of ecology and the potential for exploiting saline surface waters of Province in aquaculture - Dehram River. Iranian Fisheries Science Research Institute, Tehran. 62 pp. In Farsi.

Zamanpoore, M., Daremipouran, M. R., Ghaed-Abdi, M. R. and Ahmadi, N. Kh. 2019. Chemical and physical properties of Maharlu salt lake (Iran) prior to an extensive drought. Ecopersia, 7(1):59-67.

Zamanpoore, M., Ebrahimi, M., Zare, P., Yaripour, S. and Rahimi, M. 2021. Growth aspects, CPUE and stock size estimation for fish populations of Dorudzan Reservoir, Fars Province. Iran. Journal of Applied Ichthyological Research, 8(3):63-72. In Farsi.

Zamanpoore, M., Ghaedabdi, M. R., Essaei, A. R. and Esmaeili, H. R. 2016. Effects of drought on ecological properties and water quality of Dorudzan reservoir. Iranian Fisheries Science Research Institute, Tehran. 72 pp. In Farsi.

Zamanpoore, M. and Yaripour, S. 2017. Species composition and spatial distribution of fishes in Dorudzan Reservoir Fars Province, Iran. Iranian Scientific Fisheries Journal, 25(4):145-153. In Farsi.

Zamatkesh, A. and Karimzadeh, K. 2018. Study of growth performance and survival of kutum (*Rutilus frisii kutum*) fed diets containing different levels of protein and zinc. Journal of Applied Ichthyological Research, 6(2):73-90. In Farsi.

Zand, M., Morshedi, F. and Javan, M. 2007. Rehabilitation of ancient diversion dams of Kor River in Fars Province, Iran. International History Seminar on Irrigation and Drainage, Tehran, 2-5 May 2007, pp. 255-261.

Zand, N., Sakian Mohammadi, A. and Eshaghi, M. R. 2017. Effect of modified atmosphere packaging and multi-layer flexible films on pH of smoked kutum (*Rutilus frisii kutum*). International Journal of Aquatic Science, 8(1):34-40.

Zangani, S. A., Emadi, H., Jamili, S. and Mashinchian, A. 2017. DNA damage and hematological changes in common carp (*Cyprinus carpio*) exposed to oxadiazon. International Journal of Aquatic Biology, 5(6):387-392.

Zanoosi, A. P. 1993. The importance of site selection for beach seining in the Caspian Sea. Abzeeyan, Tehran, 4(7):44-45. In Farsi.

Zanoosi, A. P. 1994. Prohibited fishing or recruitment. Abzeeyan, Tehran, 4(11):56, III. In Farsi.

Zanusi, A. 1995. Fishing resources in the southeastern corner of the Caspian Sea. Marine Animals, Research and Science, Tehran, August-September:67-73 (internet version: http://netiran.com/press/economy-domestic/html/000000XXDE0062.html).

Zarbalieva, T. S. 1987. Information on the feeding of kutum, Rutilus frisii kutum, along the

western coast of the southern Caspian Sea. Journal of Ichthyology, 27(4):170-173.

Zardoya, R. and Doadrio, I. 1999. Molecular evidence on the evolutionary and biogeographical patterns of European cyprinids. Journal of Molecular Evolution, 49(2):227-237.

Zare, M., Abdoli, A., Khoramian, S. and Borhani, M. 2014a. Length-weight relationship and condition factor of common goldfish (Cyprinidae: *Carassius auratus*), in Karkheh River of Andimeshk. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Zare, M., Abdoli, A., Khoramian, S. and Borhani, M. 2014b. Length-weight relationship and condition factor of nazak (Cyprinidae: *Chondrostoma regium*), in the Dez River of Dezfoul. The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Zare, M., Keivany, Y., Ebrahimi, E. and Bănăduc, D. 2019. Karun River fish fauna elements. 7th Aquatic Biodiversity International Conference, Sibiu/Transylvania/Romania (abstract).

Zare, P., Moodi, S., Masudinodushan, J. and Abdoli, A. 2011. Length-weight and length-length relationships of three fish species (Cyprinidae) from Chahnimeh reservoirs, Zabol, in eastern Iran. Journal of Applied Ichthyology, 27(6):1425-1426.

Zare, S. and Ebadi, A. G. 2005. Measurement of heavy metals in fish from the Tajan River. Pakistan Journal of Biological Sciences 8(10):1460-1462.

Zare, Sh. and Kaboodvandpour, Sh. 2014. Total mercury bioaccumulation tracking in a fresh water food chain, (Sanandaj Gheshlagh Dam Reservoir, Iran). Iranian Journal of Health and Environment, 7(3):351-362. In Farsi.

Zare Gashti, Gh., Motalebi, A., Jalili, S. H., Khanipour, A. A. and Kochekian, A. 2010. The effects of methods trimming on the quality and production efficiency of fish fillet silver carp (*Hypophthalmichthys molitrix*). Journal of Aquatic Animals and Fisheries, 1(2):35-42. In Farsi.

Zare Juneghani, S. and Hosseini, S. V. 2018. Study of different thawing methods on the quality of silver carp (*Hypophthalmichthys molitrix*). Journal of Fisheries (Iranian Journal of Natural Resources), 70(3):221-230. In Farsi.

Zare-maivan, H., Bagher Nabavi, S. M. and Oryan, S. 2011. Determining resides of PCBs and agricultural insecticides in sediments of Arvand Rood River and two resident fish species (*Liza abu*, *Cyprinus carpio*) in the Persian Gulf area. Journal of the Persian Gulf (Marine Science), 2(4):27-32.

Zare Shahraki, M., Fathi, P., Ebrahimi, E., Keivani, Y. and Bruder, A. 2020. The structure of fish and macroinvertebrate communities in the Karun River system, Iran. GEO BON (Group on Earth Observations Biodiversity Observation Network) Open Science Conference & All Hands Meeting 2020, 06-10 July 2020, 100% Virtual (abstract).

Zare Shahraki, M., Hashemi, E., Darabi, A. and Jafari-Kenari, S. 2017. Study of morphometric and meristic characters of Kura barbel (*Barbus cyri*) in the southern Caspian Sea. Shil Journal, 18(5):13-24. In Farsi.

Zare-Shahraki, M., Keivany, Y., Ebrahimi, E., Bruder, A., Flotemersch, J. and Blocksom, K. A. 2020. Length-weight relationships of seven fish species from the Karun River system, southwestern Iran. Iranian Journal of Ichthyology, 7(4):352-355.

Zareh Reshquoeeieh, M., Hamidian, A. H., Poorbagher, H. and Ashrafi, S. 2016. Investigation of heavy metals accumulation in sediment and aquatic organisms in Khodaafarin Dam, Azarbaijan-Sharghi, Iran. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 29(1):72-80. In Farsi.

Zarei, F., Hosseini, S. N., Amini, S. S., Pezeshk, J., Maleki, L. and Rajabi-Maham, H. 2017. Proposing Zarivar Wildlife Refuge (Western Iran) as a Ramsar Site based on avian diversity and conservation criteria. Podoces, 12(2):27-42.

Zarei, F. and Rajabi-Maham, H. 2017. First record of exotic *Piaractus brachypomus* Cuvier, 1818 (Characiformes: Serrasalmidae) in Zarivar Lake, western Iran. Journal of Applied Ichthyology, 33(4):810-812.

Zarei, F., Sadeghi, R. and Esmaeili, H. R., 2018. Role of evolutionary model and model selection criterion in the phylogenetic relationships of carp (based on COI mitochondrial gene sequences). Conference on Conservation of Endemic Fish Species in Inland Water Ecosystem of Iran, University of Tehran, Karaj (abstract).

Zarei, H. and Pourreza Bilondi, M. 2013. Factor analysis of chemical composition in the Karoon River basin, southwest of Iran. Applied Water Science, 3(4):753-761

Zarei, I., Pourkhabbaz, A., Alipour, H. and Khazaei Sayyed, H. 2013. Acute toxicity and the effects of copper sulphate ($CuSO_4.5H_2O$) in the behaviour of the black fish (*Capoeta fusca*). Iranian Journal of Toxicology, 6(19):771-778.

Zarei, M., Ramezani, Z., Ein-Tavasoly, S. and Chadorbaf, M. 2015. Coating effects of orange and pomegranate peel extracts combined with chitosan nanoparticles on the quality of refrigerated silver carp fillets. Journal of Food Processing and Preservation, 39(6):2180-2187.

Zarei, M., Taghavi Jelodar, H. and Nazarhaghighi, F. 2017. Histopathological changes of kidney and muscle in goldfish (*Carassius auratus*) following exposure to butachlor. Veterinary Researches Biological Products (Pajouhesh va Sazandegi), 30(1):89-99. In Farsi.

Zarei, N., Eagderi, S. and Naderi, G. 2014. Habitat use of siah mahi (*Capoeta capoeta*) in Taleghan River (Sefidrood river basin). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Zarei, N., Eagderi, S., Zamani Faradonbeh, M. and Naderi, M. 2016. Study of the relationship between body length and preferred habitat factors in siah mahi (*Capoeta gracilis*, Keyserling 1861) in Taleghan River. Journal of Animal Environment, 8(1):105-112. In Farsi.

Zarei Yam, B. A., Khomeiri, M., Amirkhani, S. and Sabagh, M. 2015. Microbial quality of salted dried fish sold near Caspian Sea, Iran. Basic Research Journal of Microbiology, 2(4):61-65.

Zareian, H. and Esmaeili, H. R. 2013. Biosystematic study of *Capoeta* spp. from Iranian drainage basins. The First Iranian Conference of Ichthyology, Isfahan University of Technology, 15-16 May 2013, p. 56 (abstract).

Zareian, H. and Esmaeili, H. R. 2015. Scale deformation in the scales of *Garra persica* Berg, 1913 and *Garra rufa* (Heckel, 1843) from Iran. The Third Iranian Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 136.

Zareian, H. and Esmaeili, H. R. 2017. Mitochondrial phylogeny and taxonomic status of the *Capoeta damascina* species group (Actinopterygii: Cyprinidae) in Iran with description of a new species. Iranian Journal of Ichthyology, 4(3):231-269.

Zareian, H., Esmaeili, H. R. and Freyhof, J. 2016. *Capoeta anamisensis*, a new species from the Minab and Hasan Langhi River drainages in Iran (Teleostei: Cyprinidae). Zootaxa, 4083(1):126-142.

Zareian, H., Esmaeili, H. R. and Gholamhosseini, A. 2015. Modeling the potential distribution of *Capoeta* Valenciennes, 1842 (Teleostei: Cypriniformes) in Iran. The Third Iranian

Conference of Ichthyology, Shiraz University, Shiraz, 6-7 May 2015, Abstract Booklet, p. 147.

Zareian, H., Esmaeili, H. R. and Gholamhosseini, A. 2017. The geographical distribution of the genus *Capoeta* Valenciennes, 1842 in Iranian drainage basins. The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Zareian, H., Esmaeili, H. R. and Gholamhosseini, A. 2021. Scale deformities in three species of the genus *Garra* (Actinopterygii: Cyprinidae). Caspian Journal of Environmental Sciences, 19(2):231-238.

Zareian, H., Esmaeili, H. R., Gholamhosseini, A., Alwan, N. and Coad, B. W. 2016. Taxonomic status of the Mond scraper, *Capoeta mandica* (Teleostei: Cyprinidae) based on morphological and molecular data. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Zareian, H., Esmaeili, H. R., Gholamhosseini, A., Alwan, N. and Coad, B. W. 2018. Comments on the Mond Scraper, *Capoeta mandica* (Teleostei: Cyprinidae): Re-description, molecular systematics and distribution modeling. Journal of Ichthyology, 58(3):283-295.

Zareian, H., Esmaeili, H. R., Gholamhosseini, A., Japoshvili, B., Özuluğ, M. and Mayden, R. L. 2017. Diversity, mitochondrial phylogeny, and ichthyogeography of the *Capoeta capoeta* complex (Teleostei: Cyprinidae). The Fifth Iranian Conference of Ichthyology, Islamic Azad University of Babol, 13-14 December 2017 (abstract).

Zareian, H., Esmaeili, H. R., Gholamhosseini, A., Japoshvili, B., Özuluğ, M. and Mayden, R. L. 2018. Diversity, mitochondrial phylogeny, and ichthyogeography of the *Capoeta capoeta* complex (Teleostei: Cyprinidae). Hydrobiologia, 806(1):363-409 (First published online, pp. 1-47, 3 October 2017; volume number and pages added in December 2017 for January 2018 print version, so date often given as 2017).

Zareian, H., Esmaeili, H. R., Gholamhosseini, A. and Sayyadzadeh, G. 2013. New records and geographical distribution of *Alburnus hohenackeri* Kessler, 1870 (Teleostei: Cyprinidae) in Iran. Checklist, 9(4):829-831.

Zareian, H., Esmaeili, H. R., Heidari, A., Khoshkholgh, M. R. and Mousavi-Sabet, H. 2016. Contribution to the molecular systematics of the genus *Capoeta* from the south Caspian Sea basin using mitochondrial cytochrome b sequences (Teleostei: Cyprinidae). Molecular Biology Research Communications, 5(2):65-75.

Zareian, H., Esmaeili, H. R., Zamanian Nejad, R. and Vatandoust, S. 2015. *Hemiculter leucisculus* (Basilewsky, 1855) and *Alburnus caeruleus* Heckel, 1843: new data on their distributions in Iran. Caspian Journal of Environmental Sciences, 13(1):11-20.

Zareian, H., Gholamhosseini, A. and Esmaeili, H. R. 2016. Mapping the climate suitability for the Mond scraper, *Capoeta mandica* (Teleostei: Cyprinidae), using the MaxEnt modeling approach. The Fourth Iranian Conference of Ichthyology, Ferdowsi University of Mashhad, 20-21 July 2016 (abstract).

Zareian, H., Gholamhosseini, A. and Esmaeili, H. R. 2018a. Length-weight and length-length relationships of 15 algae scraper fishes of the genus *Capoeta* (Cyprinidae) in Iran. Journal of Applied Ichthyology, 34(6):1354-1357.

Zareian, H., Gholamhosseini, A. and Esmaeili, H. R. 2018b. Estimation of length-weight relationship in some algae scraper fishes of the genus *Capoeta* (Cyprinidae) in Iran. The 6th Iranian Conference of Ichthyology, Shahid Bahonar University of Kerman, 27-28 August 2018 (abstract).

Zareian, H., Gholamhosseini, A., Esmaeili, H. R. and Teimori, A. 2012. Vertebrates of Kuh-e-Gorm non-hunting area, Jahrom, Iran: Diversity, conservation and challenges. Iranian Journal of Animal Biosystematics, 8(2):169-182.

Zareian, H., Gholamhosseini, A., Esmaeili, H. R. and Zohrabi, H. 2012. The vertebrate fauna of Kuh-e-Gorm non-hunting area, in southern Iran and its conservation status. The 17th National and 5th International Iranian Biology Conference, Shahid Bahonar University, Kerman, 4-6 September 2012, p. 8 (poster).

Zargaran Hoseini, M. and Chelemal Dezfulnejad, M. 2018. The effect of utilization of banana peel powder in diet on growth, survival and body composition of common carp (*Cyprinus carpio*). Journal of Applied Biology, 31(1):109-120. In Farsi.

Zarin Kamar, H. 1996. Survey of feeding habits of kutum in Bandar Anzali coastal waters. M.Sc. Thesis, Islamic Azad University, Tehran. 150 pp. In Farsi.

Zarkami, R., Darizin, Z., Sadeghi Pasvisheh, R., Bani, A. and Ghane, A. 2019. Use of data-driven model to analyse the occurrence patterns of an indicator fish species in river: A case study for *Alburnoides eichwaldii* (De Filippi, 1863) in Shafaroud River, north of Iran. Ecological Engineering, 133:10-19.

Zarkami, R., Moradi, M., Sadeghi Pasvisheh, R., Bani, A. and Abbasi, K. 2018. Input variable selection with greedy stepwise search algorithm for analysing the probability of fish occurrence: A case study for *Alburnoides (sic) mossulensis* in the Gamasiab River, Iran. Ecological Engineering, 118:104-110.

Zarrineh, N. and Azari Najaf Abad, M. 2014. Integrated water resources management in Iran: Environmental, socio-economic and political review of drought in Lake Urmia. International Journal of Water Resources and Environmental Engineering, 6(1):40-48.

Zarudnyi, N. 1896. Marshrut N. A. Zarudnego po vostochnoi Persii v 1896 g. [Itinerary of N. A. Zarudnyi in eastern Persia in 1896]. Ezhegodnik Zoologicheskogo Imperatorskogo Muzeya Akademii Nauk, St. Petersburg, 1:18-21.

Zarudnyi, N. 1898. Marshrut N. A. Zarudnego po vostochnoi Persii v 1898 g. [Itinerary of N. A. Zarudnyi in eastern Persia in 1898]. Ezhegodnik Zoologicheskogo Imperatorskogo Muzeya Akademii Nauk, St. Petersburg, 3:5-12.

Zarudnyi, N. 1901. Ekskursiya po vostochnoi Persii [An excursion through eastern Persia]. Zapiski Imperatorskogo Russkogo Geograficheskogo Obshchestva po Obshchei Geografii, St. Petersburg, 36(1):362 pp., map.

Zarudnyi, N. 1902. Marshrut exspeditsii Imper. Russk. Geograf. Obshchestva nachal'stvom N. Zarudnego po vostochnoi Persii v 1900-1901 gg. [Itinerary of the expedition of the Imperial Russian Geographical Society to eastern Persia in 1900-1901]. Ezhegodnik Zoologicheskogo Imperatorskogo Muzeya Akademii Nauk, St. Petersburg, 7(1-2):1-9.

Zarudnyi, N. 1903. O gadakh i rybakh vostochnoi Persii. Gerpetologicheskie i ikhtiologicheskie resul'taty ekskursii po vostochnoi Persii v 1898 g. [Reptiles, amphibians and fishes of eastern Persia. Herpetological and ichthyological results of the trip to eastern Persia in 1898]. Zapiski Imperatorskogo Russkogo Geograficheskogo Obshchestva po Obshchei Geografii, St. Petersburg, 36(3):1-42.

Zarudnyi, N. 1904. Marshrut puteshestviya po zapadnoi Persii v 1903-1904 gg. [Itinerary of the expedition in eastern Persia in 1903-1904]. Ezhegodnik Zoologicheskogo Imperatorskogo Muzeya Akademii Nauk, St. Petersburg, 9:45-51.

Zarudnyi, N. 1916. Tret'ya ekskursiya po vostochnoi Persii (Khorasan, Seistan i Persidskii Beludzhistan) [Third excursion throughout eastern Persia (Khorasan, Seistan and Persian

Beluchistan)]. Zapiski Imperatorskogo Russkogo Geograficheskogo Obshchestva po Obshchei Geografii, St. Petersburg, 50:448 pp.

Zauderer, J. 1988. The qanats of Yazd. In: Hydrology and Water Resources in Arizona and the Southwest (Proceedings of the 1988 Meetings of the Arizona Section, American Water Resources Association and the Hydrology Section, Arizona-Nevada Academy of Science), University of Arizona, Tucson, Arizona, 18:97-109.

Zazanashvili, N., Garforth, M. and Bitsadze, M. (Eds.). 2020. Ecoregional Conservation Plan for the Caucasus, 2020 Edition: Supplementary Reports. World Wildlife Fund and KfW, Tbilisi. 175 pp.

Zazouli, M. A., Bandpei, A. M., Mirbagheri, S. A. and Esfandyari, Y. 2013. Survey on monthly variations of water quality in the Tajan River (Sari, Iran). African Journal of Biotechnology, 12(25):3984-3991.

Zehtabvar, O., Tootian, Z., Keramat Amirkolaie, A., Davudypoor, S. and Shadi Mazdaghani, M. 2012. Anatomical study of the digestive tract of grass carp (*Ctenopharyngodon idella*). Veterinary Journal (Pajouhesh va Sazandegi), 25(4):45-51. In Farsi.

Zehzad, B. 1991. Preliminary identification of Gorgan Gulf and its fisheries reserves. In: Articles of the National Conference on the Suitable Exploitation of Marine Reserves of the Caspian Sea, Babolsar. Iranian Fisheries Corporation Publications, Jehad-e Sazandegi, Tehran.

Zehzad, B., Kiabi, B. H. and Madjnoonian, H. 2002. The natural areas and landscape of Iran: an overview. Zoology in the Middle East, 26(1):7-10.

Zehzad, B., Madjnoonian, H., Darreh Shouri, B. F., Ziaie, H. and Samanpour, M. R. 1997. Geno Protected Area (Biosphere Reserve). Hormozgan Provincial Office, Department of the Environment and Shahid Beheshti Research Bureau, Tehran. 70 pp. In Farsi.

Zehzad, B., Madjnoonian, H., Darreh Shouri, B. F., Ziaie, H. and Samanpour, M. R. 1998. Hara Protected Area (Biosphere Reserve). Hormozgan Provincial Office, Department of the Environment and Shahid Beheshti Research Bureau, Tehran. 69 pp. In Farsi.

Zeinab, H., Shabany, A. and Kolangi Miandare, H. 2015. Warning of reducing genetic diversity of *Abramis brama* (Berg, 1905) (*sic*) in Gilan coast using SSR markers. Journal of Cell and Molecular Research, 7(2):108-114.

Zenkevich, L. A. 1957. Caspian and Aral Seas. Geological Society of America Memoir, 67(1):891-916.

Zenkevitch, L. 1963. Biology of the Seas of the U.S.S.R. George Allen & Unwin, London. 956 pp.

Zeynali, F., Tajik, H. and Asri Rezaie, S. 2009. Evaluation of copper and zinc levels in muscles of some fish species of Caspian Sea. Iranian Veterinary Journal, 4(4)(21):84-89. In Farsi.

Zeynali, F., Tajik, H., Asri-Rezaie, S. and Meshkini, S. 2009. Determination of copper, zinc and iron levels in edible muscle of three commercial fish species from Iranian coastal waters of the Caspian Sea. Journal of Animal and Veterinary Advances, 8(7):1285-1288.

Zhang, E. and Chen, Y-Y. 2006. Revised diagnosis of the genus *Bangana* Hamilton, 1822 Pisces: Cyprinidae), with taxonomic and nomenclatural notes on the Chinese species. Zootaxa, 1281(1):41-54.

Zhao, J., Xu, D., Zhao, K., Diogo, R., Yang, J. and Peng, Z. 2016. The origin and divergence of Gobionine fishes (Teleostei: Cyprinidae) based on complete mitochondrial genome sequences. Journal of Applied Ichthyology, 32(1):32-39.

Zheng, L-P., Chen, X-Y. and Yang, J-X. 2019. Molecular phylogeny and systematic revision of *Bangana* sensu lato (Teleostei, Cyprinidae). Journal of Zoological Systematics and Evolutionary Research, 57(4):884-891.

Ziadloo, E., Shahsavani, D., Kazerani, H. R. and Aslani, M. R. 2011. The effects of orally administered allicin on serum activity of some enzymes in experimental lead poisoning in common carp (*Cyprinus carpio*). Journal of Veterinary Research, 66(4):325-330. In Farsi.

Ziaee, S., Samare Hashemi, K. and Samare Hashemi, S. A. 2017. Investigation of factors affecting fresh fish consumption in Iran. Iranian Scientific Fisheries Journal, 26(3):119-127. In Farsi.

Ziaei-nejad, S., Esmailbeigi, M., Jahangiri, F., Mokhtari, M. and Ghaemi, A. 2014. Effect prymalak probiotic and mycotoxin on protein, lipid and ash factors in carcase common carp (*Cyprinus Carpio*) (*sic*). The Second Iranian Conference of Ichthyology, Faculty of Natural Resources, University of Tehran, Karaj, 7-8 May 2014 (abstract).

Ziaeinejad, S., Delavarian, R., Khaki, F. and Johari, S. A. 2018. Tissue accumulation of colloids of silver nanoparticles on gill and caudal peduncle muscle tissues in common carp (*Cyprinus carpio*). Journal of Aquaculture Development, 12(4):83-94. In Farsi.

Ziai, Z. 1971. Inland fish program for the fifth Development Plan. Iran Game and Fish Department, Tehran. MS. In Farsi.

Zivotofsky, A. Z. and Amar, Z. 2006. Identifying the ancient shibuta fish. Environmental Biology of Fishes, 75(3):361-363.

Zohary, M. 1963. On the geobotanical structure of Iran. Bulletin of the Research Council of Israel, Botany, 11D, Supplement:1-113 pp., map.

Zolfaghari, Gh. 2018. Risk assessment of mercury and lead in fish species from Iranian international wetlands. MethodsX, 5:438-447.

Zolfaghari, Gh., Delsooz, M. and Rajaee, S. 2016. Study of mercury pollution in water, sediments, and fish from Hamoon International Wetland. Journal of Water and Wastewater, 27(5):25-37. In Farsi.

Zolfaghari, Gh. and Delsouz, M. 2016. Lead pollution in Hamoon wetland: interspecific differences in fish and standards and guidelines for humans. Journal of Wetland Ecobiology, 7(4):23-36. In Farsi.

Zolfaghari, Gh., Esmaeili Sari, A. and Ghasempouri, S. M. 2008. Mercury concentration in fishermen’s hair and fishes in the south of the Caspian Sea: levels, specific accumulation and risk assessment. Journal of Environmental Science and Technology, 36(special issue).

Zolfaghari, Gh., Esmaeili Sari, A., Ghasempouri, S. M., Ghorbani, F., Ahmadifard, N. A. and Shokri, Z. 2007. The comparison of relation between age, sex and weight with mercury concentration in different tissues of *Chalcalburnus chalcalburnus* (*sic*) from Anzali Wetland, Iran. Journal of Marine Sciences and Technology, 5(3-4):23-31. In Farsi.

Zolfaghari, Gh., Safari, O. and Atabati, A. 2018. Non-carcinogenic quantitative risk assessment of heavy metals in 8 fish species of Iranian international wetlands by EPA/WHO instructions. Journal of Environmental Studies, 44(1):33-47. In Farsi.

Zolfaghari, M. and Imanpour, M. R. 2013. Effect of light, color and music on cortisol and glucose of blood as stress indices in goldfish (*Carassius auratus*). Iranian Journal of Biology, 25(4):536-547. In Farsi.

Zolfaghari, M., Shabanpour, B., Shabani, A. and Ghorbani, R. 2010. Relationship of biochemical composition and fillet yield with size of Caspian Sea carp (*Cyprinus carpio*). Journal of Fisheries (Iranian Journal of Natural Resources), 63(2):71-83. In Farsi.

Zolfaghari, M., Shabanpour, B., Shabani, A. and Shirani Bidabadi, F. 2010. A comparison of nutritional value and a survey of nutritional and financial proportion of various sizes of silver carp (*Hypophthalmichthys molitrix*) in spring season. Iranian Food and Technology Research Journal, 6(3):168-175.

Zolfaghari, M., Shabanpour, B., Shabani, A. and Shirani Bidabadi, F. 2011. Survey of nutritional and economic values of bighead (*Hypophthalmichthys nobilis*) in various sizes. Iranian Scientific Fisheries Journal, 20(1)(74):43-52. In Farsi.

Zolfinejad, K., Khara, H. and Filizadeh, Y. 2017. Food preference and growth of grass carp, *Ctenopharyngodon idella* (Cuvier and Valenciennes, 1844) fed some aquatic and terrestrial plants. Iranian Journal of Fisheries Sciences, 16(4):1278-1286.

Zoriasatain, N. 2008. Benthic fauna and water quality in Gorganrood River, Iran. Ph.D. Thesis, Science and Research Branch, Islamic Azad University, Tehran. 104 pp. In Farsi.

Zorriasatein, N., Dehzhad, B., Vossoughi, G., Shapoori, M. and Jamili, S. 2009. Benthic fauna and water quality in southern Caspian Sea estuary: A case study on Gorganrood River. Journal of Environmental Sciences, 3(5):599-603.

Zorriehzahra, M. E. J. 2003. Primary environmental survey on ecological aspects of Haraz River in north of Iran. Canadian Conference for Fisheries Research (CCFFR)/Conférence canadienne de la recherche sur les pêches (CCRP), 2-5 January/janvier 2-5 2003, Ottawa, Ontario (abstract).

Zorriehzahra, S. J. 2014. Study on viral nervous necrosis (isolation, characterisation and pathogenesis) in golden grey mullet in the Caspian Sea and study of pathogenicity and possibility of transmission to the other fish species (Sturgeon fishes, *Rutilus frisii kutum* and reared Rainbow trout and Carp). Iranian Fisheries Science Research Institute, Tehran. 184 pp. In Farsi.

Zugmayer, E. 1912. Eight new fishes from Baluchistan. The Annals and Magazine of Natural History, 8(10):595-599.

Zugmayer, E. 1913. Die Fische von Balutschistan. Mit einleitenden Bemerkungen über die Fauna des Landes. Wissenschaftliche Ergebnisse der Reise von Dr. Erich Zugmayer in Balutschistan 1911. Abhandlungen der Königlich Bayerischen Akademie der Wissenschaften Mathematisch-physikalische Klasse, 26(6):1-35.

Tamam shud.

Sunset over Bam Citadel, Kerman, Brian W. Coad.

Carps and Minnows of Iran

This work provides a guide and general overview of two important freshwater fish families in Iran, the Carps (Cyprinidae) and the Minnows (Leuciscidae). There is also an extensive General Introduction covering Materials and Methods, Environment (Geography, Climate, Habitats, Drainage Basins), History of Research and Fisheries. In addition there are Checklists of Species, Identification Keys and a section on Biodiversity.

The work is illustrated by over 1800 line drawings and colour images of fish and habitats. The extensive Bibliography covers the two fish families and related Iranian families as well as the Iranian environment and has over 6800 references.

The Carp Family in Iran contains 14 native genera and 66 species with 3 exotics. Twenty-five species are endemics. The Minnow Family contains 14 native genera and ca. 47 species with 21 species endemics. Some species are members of the charismatic megafauna, commercially important or of cultural significance, and all are a siginficant component of the Iranian freshwater ichthyofauna and ecosystems.

Each species account comprises line drawings and colour photographs of the fish, common names, systematics, key characters, morphology, sexual dimorphism, colour, size, distribution, zoogeography, habitats and some habitat photographs, age and growth, food, reproduction, parasites and predators, economic importance, experimental studies, conservation and sources. This information is based on literature, field observations and museum specimens.

Volume 1 comprises the General Introduction and the Carp Family and Volume 2 the Minnow Family and the Bibliography.

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Brian W. Coad graduated from the University of Ottawa with a Ph.D. in 1975 and was successively Associate Professor, Shiraz University, Shiraz, Iran, and Curator of Fishes and Research Scientist at the Canadian Museum of Nature, Ottawa. He retired in 2016 but continues to work on fishes as a Museum Research Associate, particularly those of Iran. He is the author of over 450 scientific and popular works on fishes listed at his website www.briancoad.com. The website includes extensive sections on *Fishes of Canada: An Annotated Checklist*, a *Dictionary of Ichthyology*, *Freshwater Fishes of Iran*, and *Fishes of Canada's National Capital Region*. Major published works include the books *Guide to the Marine Sport Fishes of Atlantic Canada and New England* (1992), *Encyclopedia of Canadian Fishes* (1995), *Expedition Field Techniques: Fishes* (1998), *Fishes of Tehran Province and adjacent areas* (2008), *Freshwater Fishes of Iraq* (2010; in Arabic 2018), *Fishes of Afghanistan* (2014) and *Marine Fishes of Arctic Canada* (with J. D. Reist, 2018).